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Certified that this thesis **"PRODUCTION AND MARKETING MANAGEMENT OF MARINE FISHERIES IN KERALA"** submitted by **Mr. S.NATARAJAN** for the award of **Ph.D.** Degree of the Madurai Kamaraj University, is a bonafide record of the research work done by him at the University for the degree, and that it has not previously formed the basis for the award of any degree, diploma, associateship or any similar title, and that it is an independent work done by him.

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DECLARATION

I hereby declare that this work titled **"PRODUCTION AND MARKETING MANAGEMENT OF MARNE FISHERIES IN KERALA"** has been carried out by me under the guidance and supervision of **Dr.R.E. BENJAMIN M.A., Ph.D.,** Professor of Economics, School of Economics, Madurai Kamaraj University, Madurai - 21 and that this has not been submitted elsewhere for any other degree.

Place: Tuticorin

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(S.NATARAJAN)

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I N T R O D U C T I O N

Marine Fisheries in India play an important role in the economy of the country. It helps in augmenting food supplies, generating employment, raising nutritional level and earning foreign exchange. More than 60% of people in India consume fish as a food item. Fish is considered exceptionally valuable from the nutritional point of view, as it contains a high percentage of readily digestible animal protein. Food containing protein has to be consumed by human beings daily as it can not be stored in the body like fats and carbohydrates. But we face the problem of deficiency of protein due to the explosion of population in our country.

India's population estimated is at around 770 million (Mid 1987 Estimates) and it continues to grow at around two percent a year (Kapoor, 1987). The average annual percapita consumption of fish in India is only about 2.8 Kg which works out to be about 8 gm of fish per day. To completely wipe out the protein deficiency in the country we need to produce ten times the quantity of fish. i.e. 20 million tonne (Rangasamy, 1973). The percapita availability of land which was about 0.94 hectare in 1951 will decline to 0.33 hectare in the year 2000 (Khanna and Pavate, 1987).

As the agricultural food producing land resource is limited the increasing share of future food supply needs, especially of developing country like India, may have to be met from fisheries. Thus the development of exploited and unexploited marine fisheries resources

and its effective management offer a promising solution to the food and malnutrition problem of our country.

Hence, the responsibility rests with the management in drawing up the developmental programme for enhancing production of fish and the productivity of fishermen, fish farmers and fishing industries, rising the nutritional standard of people, improving socio-economics conditions of traditional fisherman and conservation of depleted species of fish.

The main land of India is surrounded by sea on three sides with vast potential in terms of living and nonliving resources. The Indian Ocean including Antarctica has an area of about 75 million square kilometres which is roughly one fifth of the total area of the world ocean (Nair and Pillai, 1983). However, the fish production from this ocean is only about 4 million tonnes which is about one twelfth of the world annual catch. India is the largest among the countries bordering India Ocean with about 2 million km^2 of sea and land area of about 3.2 km^2, contributing to about 45% of the fish production from the region.

The length of the Indian coast line is about 7100 km and the exploitable fish resource potential estimated is around 4.57 million tonnes (George et al., 1977., James, 1988) and aboutt 2.5 million people in India depend on marine fishing and related activities for their livelihood. Around 1.5 lakhs crafts-both mechanised and nonmechanised using about one lakh fishing gears of different types are their main tools for landing the fish (Anon., 1981).

The marine product of India has attracted many new customers in foreign markets and brought about a new era of hopes and optimism to fishing community. The fisherfolk get better prices for their catchhes and gain respect and recognition in society as primary producers of raw materials for marine export Industry. The foreign exchange earnings of fishing sector have increased from Rs.46 crores in 1960-61 to Rs.2503.62 crores during 1993-94, equivalent to US dollar 798.25 million. This is the highest export ever recorded. The quantity exported during 1993-94 was 243960 tonnes which is 34933 tonnes higher (16.71%) than the previous year. In terms of value when compared with previous year was Rs.735.06 crores (41.56%). The average unit value realisation recorded substantial increase from Rs.84.61 per kg to Rs.102 per kg. This increase was mainly due to export of high-valued items like shrimp, frozen squid and cuttlefish. This growth in export market over the last three decades contributed substantially to the economic development of our Country.

The marine fish landing was about 0.6 million tonnes in the early fifties. 0.7 million tonnes in sixties, 1.12 million tonnes in seventies, 1.7 million tonnes in late eighties and 4 million tonnes during 1992-93.

The developmental and management problems of fishery resources are so complex. In rellation to resources and their utilities the marine fishery has to be considered differently from agriculture or mining industry (Chidambaram, 1983., Subbarao, 1985). In the case of

agriculture the progress of the growing crops can be monitored regularly and precautionary action can be taken on the standing crops whenever required as or the production factors like varieties of crops, nature of the area. etc. are known. Similarly, for mineral resources, the production (mining) involve only the estimation and tapping the known and fixed resources. whereas fish is always in the move in the three dimensional winter body. highly perishable, dynamic and multispecies resources of common properties. The raw materials viz. the living finfishes and shellfishes. though caughht in different waters, they are to be brought to the selected centres either on the coast (Fishing Harbour) or on the seas (Factory Ship) for further handling and distribution to different customers through the different marketing channel.

Though the estimated stock is about 4.7 million tonnes the exploited level of fishery resources in our country, in general is far below the optimum level which may be due to the inadequate management policies and their improper implementation. The ultimate aim of the marine fishery management is to make use of the available fish resources without endangering their renewability. But as the nature would have it, the quantum of resources ameanable for exploitation which is called the "Maximum Sustainable Yield" (MSY) appears to be more or less constant. The primary task of the management is to monitor the fish stock, their distribution in space and time, migration, seasonal fluctuation in their abundance, annual recruitment level, optimum level of harvesting etc and to determine

the effort needed to exploit the permissible level of resources avoiding depletion due to continuous and over exploitation. In recent days Hydro-Accoustic Instruments such as echo-sounder, sonar, echo-integrator, trawl sonde etc. are used to collect the required data in a systematic manner and Electronic Data processing (E D P) system are used to analyse the large mass of data into meaningful information helpful for the decision-making in the effective management.

With regard to the exploitation of resources there is an implicit conflict between the different production sectors and within each sector, between the end users. For example there is a conflict in Agriculture, between diffferent crops for the available land. In fisheries, the conflict manifests itself between inland and marine sector within the marine sector between the mechanised sector and the traditional sector; and within the traditional sector, between the motorised and non-motorised sector. In marketing, there is always conflict between the potential demand and the potential supply as determined by the "Maximum Sustainable Yield". The responsibility rests with the fishery management to resolve these conflicts and to ensure maximum social gain in terms of marketing and employment.

In the field of marine fisheries, the problem of production and marketing are inter-dependant. An integrated approach at the regional level is quite essential for suggesting management strategies. The sustenance of the different harvesting techniques of marine fishery depends upon its profitability which is the function of market demand

and the unit price of the produce. The past experience has revealed that the fisheries development depends initially on detailed estimation of fish resources and the way inwhich they respond to the changes in fishing methods (Khorshid and Morgan, 1980). The data on marketing and infrastructural aspects also are essential for analysing the multi-input and multi-objective problems of marimne fisheries for effecting the fisheries management efficiently and effectively (David cushing, 1975; Vito Blomo et al., 1978).

The thrust of fisheries research in India so far has been centered around on biological and technological aspects, mainly at the exploitation of fisheries resources. On the other hand the social and economic aspects of marine fisheries research has been completely ignored (Subbarao, 1987). Only recently there has been some contribution on specific problems relating to economics of different fishing methods, impact of mechanisation, marketing, etc. A few micro level studies on the costs and the earnings of different crafts - gear combinations indicate that the introduction of mechanised fishing vessels such as trawlers, gillnetters and purse-seiners along the west coast of India has had positive economic impact. However, later investigations are skeptical about this and point out various conservation problems and the negative effect of mechanisation.

Further, the cost and earnings of the same type of craft - gear combination differ considerably from region to region. With regard to marine fish marketing, a few study conducted at the national and regional levels (Anon., 1984; Saxena, 1983; Rao, 1983; Panikker et al., 1990) could not integrate the productions sector in order to give

meaningful suggestions for coordinated and overall management. Hence, the present investigation to study the production and marketing aspects together is a pioneering attempt in the marine fishery sector. However, considering the limitations on the availability of limited man power, material and time, the study is limited to Kerala State only.

The State of Kerala, located in the Southern part of the Peninsular India has a narrow stretch of lush green land with a long surf-beaten coast on the western side between 08^{o} 18' N and 12^{o} 48' N and 74^{o} 52' E and 77^{o} 22' E. Its other boundaries are the western ghats interspersed with rivers in the east, Arbian Sea in the west, the State of Karnataka and Tamil Nadu in the north and south respectively.

Kerala with its 590 km long coastline, less than one tenth of the total and continental shelf area of about 40,000 km^{2}. Indian Coast, enjoys one of World's most productive seas bordering it and it produces an average of 24% of India's total annual fish landings (James et al., 1991; Alagaraja et al., 1994). The fishermen population as per the Kerala State Government Publication, during 1986 is reported to be 6.7 lakhs. Considering an annual growth rate of 0.3% the conservative projection of population in 1993 would be above 6.84 lakhs. 22.74% of the total fishermen population are reported to be the active fishermen engaged in the fishing activities. There are about 5026 mechanised boats 7984 motorised country crafts and 27104 non-motorised country crafts operating along the Kerala Coast (Sathiadhas et al., 1995). The main fishing gears used are trawl nets, purseine ents drift/gillnets, boat seines, hooks and lines, shore seines, traps and scoop nets.

In view of the importance of marine fishery in the economy of the Kerala State, the present investigation is carried out setting forth the following objectives :

i) To review the fish stock assessment methods with special reference to Acoustic Survey using echo-sounder and Echo-integrator.

ii) To examine the recent developments in fishing techniques, production trend and variation in the composition of marine fish catch over the years.

iii) To evaluate the cost and earnings of different craft - gear combinations in marine fishing operations.

iv) To study the marine fish marketing problems, to determine price spread for different varieties of fish and to assess the share of fishermen and middlemen in the consumer's rupee.

v) To suggest management measures, to enhance the level of production, product development to increase the profitability of different types of fishing units and to improve marketing efficiency of marine fishery resources: by introducing non-conventional added value fish.

vi) To evaluate the Government policy related to fisheries briefly and to recommend positive changes.

Hypotheses

In spite of the enormous scope and potential of marine fisheries, majority of fishermen who depend on this industry, still live under the low income group due to various production and marketing problems. The present study attempts to identify the major

problems and prospects in the marine fisheries industry of Kerala. The practical utility of this investigation is that it will be quite helpful to evolve appropriate production and marketing management strategies in future to increase the productivity of capture fisheries and efficiency of marketing system in Kerala. The present study attempts to test the following hypotheses.

1) Indigenous low-cost fishing units cannot survive in the long run and all out mechanisation is the only remedy for optimising the marine fish production.
2) Motorisation of country craft helped the fishermen to improve their living condition.
3) The shrimp catch per unit effort of trawlers is continuously declining due to overfishing, consequently its sustenance is being threatened.
4) In marine fishery, fishermen use factors of production in a rational way.
5) Lesser the number of intermediaries in the fish marketing chain higher is the share to fishermen in the consumer's rupee.
6) Acoustic Survey is one of the best methods for the fish resources estimation which provides fishery management informations.

Limitations of the study

This study pertains to the year 1992-93 and values of input and output are subject to change. The returns in terms of total catch and species-composition of the catch, price of different varieties of fish often show wide fluctuations. This is the major limitation of any study on costs earnings or marketing in marine fishery.

Innumerable types of fishing techniques are adopted by fishermen all along the coast. There is lot of regional differences. It is very difficult to cover all the centres or all types of fishing methods in the entire coast. However, maximum care has been taken to include all important types of craft - gear combinations at representative centres to arrive at general conclusions.

Layout of the study

Chapter II consists of the review of relevant literature and its applications to the present study.

Chapter III deals with the materials and methods. It gives an account of the sources of data collected, sampling design of primary data collection and the tools applied for analysis.

Chapter IV consists of general profile. landing centres, and the activities in detail.

Chapter V projects the fishery production trend, available resources and its survey by Acoustic method.

Chapter VI discusses the various technological options for fishing available to the fishermen and their capital requirements. The technical details about the craft and gears are also briefly dealt with.

Chapter VII encompasses the costs and earnings of different types of fishing units operating along Kerala Coast.

Chapter VIII analyses the input - ouput relationship for some of the selected craft - gear combinations using Cobb-Douglas Production function model. To bring out the comparative economic efficiency of different craft - gear combinations, a set of key economic indicators have been listed for all types of fishing units operating at different centres.

Chapter IX deals with the fish marketing price structure and profit margins. Further, the inter-relationship of landing, wholesale and retail prices have been discussed in detail for all commercially important fishes.

Chapter X contains the summary of findings, conclusion and policy implications.

CHAPTER II

REVIEW OF LITERATURE

The need for fishery management assumed importance in recent years on account of the uncontrolled or rather reckless exploitation of resources in many countries leading to depletion of stock (Mac Lenman, 1981; Courtland, 1990). Although according to available information, the level of exploitation of the fishery resources in India. in general. is far below the optimum, there seems to be too much concentration in certain areas and in respect to certain speecies which perhaps is a reflection of the lack of fishery management policies or their implementation (Govindan, 1983; Choudhury, 1986). The technological build up in the sphere of exploitation of ocean resources is not yet systematically designed and properly supported (Kholi, 1978). Fisheries resources are living and self-renewing in nature. Marine Fishery is concerned with national exploitation of aquatic production (Subba Rao. 1986). The prevailing situation in the fisheries sector in many countries of the world can be briefly stated as (i) insufficient information of fish resources, (2) diminishing stock and (3) conflicting uses of coastal areas and types of fishing.

Most of the countries in the world depend on fisheries as a source rich protein food. Studying the scope of protein availability from the sea, Menon (1970) concluded that the sea and sea alone is the ultimate answer to the problem of protein deficiency, if it has to be tackled from the natural sources. Qasim (1972) indicates that if the ocean harvest is to be realized fairly rapidly changes are

necessary in developing a complex technology by which the cost of marine protein to the consumer is substantially reduced.

Saxena (1983) stressed the need for more widespread use of economic tool in formulating Indian fishery policies. He observed that there were very few studies on the economics of different types of fishing methods and economic status of fishermen. The paucity of such studies has resulted in ineffective fishery policies in the country. He further indicated the lack of systematic collection of economics-oriented fishery statistics regarding investments, returns, marketing costs and margins of different intermediaries in marine fisheries sector.

The size of investment in marine fisheries has been so modest that it can be said to be insignificant as compared to other sectors (Kalawar, 1985; Chua Thia-Eng, 1986). In all the Five year and Annual plans, the share of the fishery sector never exceeded 0.5 per cent on an average. The capital investment in fishing industry trailed behind all the other sectors of Indian economy particularly when compared with agricultural investment (Rao and Rao, 1989). The extent of Exclusive Economic Zone (EEZ) available for fishing exploitation, is equal to two thirds of the land area of the country. Reviewing the present status and role of small-scale fisheries of India, Bapat and Kurian (1981) pointed out that land is definitely going to be a limiting factor in increasing food production. Abdul Hakim (1979) stated that any amount spent on fisheries development is justifiable as it touches some of the basic national goals. Therefore, investment on development of marine fisheries in India should be stepped up substantially after evolving an appropriate marine fisheries management policy.

Resources exploitation and production economics

The primary task of management is to determine the effort needed to exploit the allowable level of resource ((Lackey, 1978; Kesteven, 1981). It must in fact be viewed as part of the overall policy measures needed for the most rational exploitation of the total natural resources of a country. Different estimates are available with regard to the potential resources of the Indian Ocean (Silas et al., 1976; George et al., 1977; James, 1988; Sudarsan and Somvanshi, 1988). A break-up of this estimate with respect to the southwest coast, northwest coast. upper east coast and lower east coast is also available. In spite of these macro level figures, no accurate estimates regarding the resources falling within the different depth zones off different maritime States are available (Choudhury, 1986). This is a major limiting factor in deciding appropriate management measures.

Several studies carried out along the Indian Coast indicate that at present the marine fish landings are confined mostly to inshore belt upto 50 metres in depth (Gokhale, 1971; Qasim, 1973; Dharmaraja et al., 1987). The prawn resources are intensively fished due to its high export price in this belt (George et. al., 1981; Saxena, 1984; Muthu, 1988; Devaraj and Smita Chlariya, 1983). The deep sea zone beyond 50 metres depth contains about 50% of the annual potential yield. The studies further indicate that where the increase in catches from the traditionally exploited resources such as oilsardine, mackeral, bombayduck and prawns is expected to be marginal, the increase possible from additional efforts to exploit varieties, such as small tunas, whitebaits. horse mackeral, catfish, ribbonfish and thread-fin-bream is likely to be considerable. Likewise, the consideration of

edible fish bio-mass and crustaceans from the outer shelf and slope, offer good scope for exploitation. Another major potential of oceanic resources to be exploited are the larger tunas and squids (Silas and Pillai, 1982).

Discussing the growth and productivity of the Indian fisheries, Rao and Rao (1989) conclude that the marine fish production growth rate could not go up much partly due to lack of capital from the inshore area which means there is over-capitablisation fish production from the EEZ. Joseph and Radhamma (1970) studied deep sea prawn resources of the southwest coast of India. They concluded that the potentiality or abundance of a particular species is only ne of the factors determining the economic viability. They further found that there is no significant seasonal fluctuation in the abundance of deep sea prawn.

A few studies were conducted to analyse the programme of mechanisation of small boats and efforts of Government of India in relation to deep sea fishing (Chidambaram 1983; Mathai, 1983; Kalawar, 1985). They suggested alternative strategies through which India can exploit the fishery resources of the EEZ. Chidambaram (1985) in his study on "Man power planning - an assessment for the next decade" pointed out that considerable work remains to be carried out on determining the untapped fisheries resources in the deeper waters, assessing the Maximum Sus tainable Yield from the exploited fisheries and planning, control and regulatory measures, methods for rational exploitation of various fisheries resources, analytical methods in respect of production, economics and management, social and economic set up of the fisheries in different areas and extension.

Reviewing the fisheries development policies and the fishermen's struggle in Kerala, Kurien and Achari (1988) indicated that lack of clearly formulated policies has resulted in the enunciation of numerous and often mutually conflicting development objectives. Unfortunately deep sea fishing has always been associated with exports. It has also been assumed that only very capital-intensive technologies can be utilized for this. It is important to focus more on the internal market and to use a combination of capital and labour/intensive technologies to harvest this resource .

Costs and earning studies of different craft-gear combinations are very useful to know the comparative economic efficiency of different investment options. A few micro level studies were carried out about the economics of different craft-gear combinations at selected centres along the Indian Coast. Krishna Iyer et al. (1970) studied the comparative fishing ability and economic performance of 9.15 m (30'), 9.76 m (32') and 10.97 m (36') vessels operating along Kerala Coast on the basis of data for four consecutive years from 1964 to 1968. They concluded that the bigger size boats are comparatively more efficient.

Joseph (1973) analysed the economics of operation of the 17.5 mono indigenous steel trawlers along the Kerala Coast. He concluded that these boats are operating on profit and they can operate about 250 days per annum.

Noble and Narayanan Kutty (1978) studied the economics of indigenous fishing units (Thangu vala and Ayala vala) operating at

lassery near Kochi. They indicated that the gross income in relation investment is very good in the indigenous fishing units and giving proportionately higher rate of production than the mechanised units. country crafts require comparatively less investment and it can be economically put into action even when the fish in the sea is scanty.

James (1981) studied the exploited and potential capture fishery resources in the inshore waters of India. He found that the return per unit of investment of non-powered boats has been found to be twice that of the powered boats and generate almost seven times more direct employment than the mechanised boats. He concluded that attempts for diversification of fishing in coastal waters to exploit the under-exploited and non-conventional resource should be intensified for achieving a rational exploitation of the resources of the inshore areas and for maintaining a balance between the mechanised and non-mechanised fishing.

The impact of motorisation of catamarans along Thirunelveli and Kanyakumari Coast has been studied by Sathiadhas (1982). The gross and net earnings of motorised units increased due to higher catches of cuttlefish. However, he has pointed out that there is not much difference in catch and revenue between motorised and non-motorised units along Thirunelveli Coast where the wind blows favourably most part of the year enabling the non-motorised units to operate equally effectively.

Kurien and Rolf Wilmann (1982) made a detailed study on the costs and earnings of artisanal and mechanised fishing units in Kerala. Wide coverage has been given in the study by giving due representation for a number of indigenous craft - gear combinations operating along Kerala Coast. The study illustrates the technical variety of the Kerala fisheries especially of the artisanal sector. The results of the study suggest that the performance and potential of the artisanal fisheries may justify greater attention and support than has been accorded in the past. But the study has thrown light on the profitability of different investment options. and it lacks detailed information on fish marketing systems to suggest broad management strategies for the overall development of marine fisheries in the region.

Krishna Iyer et al. (1983) studied the economic efficiency of 9.82 m and 11 m fishing trawlers along Kerala Coast. They concluded that the number of fishing trips per year determines the profit and loss of the trawler. With the increase in the number of fishing trips, the profit also increases for both types of trawlers.

Unnithan et al. (1985) attempted an economic analysis of 22 m and 23 m deep sea trawlers under operation from the Visakhapatnam base of Andhra Pradesh in the east coast. The study indicated that the deep sea fishing in Indian waters is a profitable venture. However. the conomic parameters such as catch per trawling operation, cost of production, productivity per man year, energy, etc. estabilish the superiority of 23 m vessel.

Costs and earnings of traditional fishing units along Trivandrum Coast, Kerala has been studied by Sathiadhas and Panikkar (1988). The study cover catamarans with hooks and lines, catamarans with gillnets and Planckbuilt canoe fitted with OBM. Considering the catch and revenue in different seasons for these units, monsoon period (June-August) is found to be more productive and profitable. The study indicates that the catamaran units show better input-ouput and capital efficiencies as compared to OBM units since the initial investment in them is comparatively less. Catamarans with hooks and lines are highly suitable as a family enterprise for the small investors who are able to go for fishing on their own units. However, in terms of higher productivity, gross and net income and employment potential the canoe fitted with OBM is more efficient.

Panikkar et al. (1990) studied the comparative economic efficiency of mechanised boats operating at Cochin Fisheries Harbour in Kerala. They have given a set of key economic indicators to assess the comparative efficiency of purse seiners, gillnetters and trawlers and concluded purse seiners are more efficient than the other two types of mechanised units.

Saxena (1984) studied the management aspects of shrimp fishery with particular reference to India. According to him the Indian shrimp fishery after 1975 is experiencing negative growth rates, forcing the fishery to its declining stage which has been substantiated by reduction in catch per unit effort. In the light of the decline of Indian shrimp fishery, three types of tools to manage the same has been suggested - first an exhaustive techno-economic survey should be undertaken to

study the production, processing and marketing costs, margins, practices, channels, etc. alongwith the socio-economic conditions of the local fishermen in order to provide alternative employment opportunities and financial compensation. The second type of management tools includes regulatory measures and third relate to the encouragement of shrimp culture. Swamination (1976) also observed in this context that on peculiar feature of the prawn fishery is that most of the penaeid prawns are subjected to the exploitation in the juvenile phase.

Balan et al. (1989) conducted a detailed study on the impact of motorisation of country crafts in Kerala. The costs, earnings and key economic indicators for motorised and non-motorised plank built boats, canoes and catamarans operating hook and lines, boatseines and gillnets were worked out. Returns to capital and labour were comparatively more for motorised units. Further extending the area of operation and adopting diversified fishing methods become feasible due to motorisation. It has been observed that motorisation has brought an element of dignity tot he fishing profession. The study indicated that the landings of motorised craft has substantially increased during the last decade and non-motorised showed a declining trend. They further assessed the impact of motorization and other related aspects and also made suggestions for suitable management measures.

Sehara et al. (1986) observed that OBM boats are more popular in Gujarat. There is similarity in trawlnet and gillnet operation in Gujarat and Maharastra, but method of dolnet operation differs in both

the States. The non-peneaid prawns in Maharastra and Bombay-duck in Gujarat are the main stay of dolnet catches. Sehara and Karbhari (1989) studied the gillnet fisheries by OBM units along Northwest coast of India with special reference to costs and returns. Fishermen prefer OBM units since the capital investment is less and the profit investment ratio are higher. Based on various economic parameters the gillnet fishing by dugout canoes fitted with outboard engine was found to be profitable in northwest coast. The same authors (1991) also studied the economics of trawl fishing at Porbandar in Gujarat. All the economic efficiency measures show that trawl operation at Porbandar was profitable, but it requires a minimum of about 6 years to recover the capital investment with the existing rate of net income.

Datta and Dan (1989) studied the economic efficiency of different craft - gear combination prevailing along the Orissa Coast. The estimated gross returns from trawler was considerably higher than the income from other types of fishing units. But in terms of factor productivity the non-mechanised units are moore efficient.

Studying the economics of catamaran fishing along the Madras Coast, Sathiadhas and Panikkar (1991) concluded that the catamaran owners can enhance their earnings by increasing the size of craft as well as number of gears. The poor economic condition coupled with scant availability of finance from the Institutional agencies force the fishermen to sustain with less equipped fishing equipments, which in turn results in less returns entangling them in a vicious circle of poverty.

Reviewing the performance of catamarans operating along Andhra Coast, Sivasubramanian (1991) pointed out that most of the fishermen usually put out to sea without suitable gears having only one kind of gear when atleast three kinds are needed. The limitations catamarans face in terms of area covered and the length of time they can stay out at sea makes it necessary for them to use atleast three types of gear to capture different species, during the various seasons of availability within their fishing range. He went to the extent of concluding that the days of catamarans are numbered. However, this observation required further detailed investigation.

Marketing scenario of marine fish

Resource development alone cannot be sufficient for the growth of fishing unless it is coupled with infrastructure and marketing development. Discussing the marine food industry in Kanyakumari and Thirunelveli District of Tamil Nadu, Leela Nayar (1973) indicated the existence of tremendous employment potential and it was estimated that nearly 100 man days will be required to process and distribute one tonne of the finished product. Supply and demand projections of marine fish upto 1980-81 has been made by Shambu Dayal (1973) and it was helpful for formulating policies of production and marketing during the last one and a half decades.

Studies conducted on marine fish marketing pointed out that the transportation of fish is very inefficient in India (Singh and Gupta, 1983; Srivastava and Kulkarni, 1985; Sathiadhas and Panikkar, 1988). Due to inadequate transportation, no fresh fish is available in potential markets located away from the landing centres, whereas surplus fish at harbours is being sent to fish meal plants. Further it has been

observed that the catches of certain varieties such as sardines and mackerel are landed in large quantity in fishing season which results in the glut at producing centres.

Singh and Gupta (1983) examined the prevailing marketing system for different forms of fish in domestic markets. The paper in addition analysed costs, returns and risks of various market intermediaries. Mammen (1983) analysed the existing fish marketing systems with a view to suggest some alternative channels to provide better quality fish to consumer and higher returns to producers.

Panikkar and Sathiadhas (1985) studied the marketing system and price spread of some of the commercially important marine fish in Kerala State. The analysis indicated that fishermen's share of consumers' rupee varied from 31 to 68 percent. The fishermen get a better share for quality fishes having high consumer preference than for cheaper varieties. They suggested a fast and efficient transportation system for the improvement of marketing of fish. The same authors (1989) made another detailed study on marine fish marketing trend in Kerala and observed marked improvements in the system. The average annual prices for almost all varieties of fish showed a continuous increase during the decade starting from 1980. Fish marketing in Kerala has been transformed into a modern stage despite the infrastructure constraints and inherent complications in the marketing system. The fishermen's share in consumers rupee showed an increase over the years inspite of increasing marketing costs.

Sathiadhas and Panikkar (1988) made a study on market structure and price behaviour of marine fish in TamilNadu. They conclude that fish marketing in TamilNadu is still under the clutches of middlemen. Of the 25 varieties of fish covered under the study. the percentage of marketing margin in consumers price for 20 varieties which constitute 90 percent of landings worked out at more than 40 percent.

Abdul Hakim (1979) indicated that the Indian sea food export growth was stimulated by heavy demand from abroad. As a result. Indian products were never "marketed" but only passively "supplied". Because heavy demand and vast markets existed for Indian shrimps abroad. the importing country or agency offered higher prices than those existed within the country. The Indian exporters attracted by this price differences have been contributing their share to the various world markets. They fail to exploit the demand structure to their advantage.

Saxena (1970) analysing the price behaviour of Indian frozen shrimps in U.S. markets narrated that the price we realised for our shrimps was only one third to one half of the value on a pound basis when compared to what other countries realised for their exports. He suggested a detailed study by a team of marketing and processing experts to improve the image of Indian shrimps and other marine product exports.

Studying on the scope for diversification of marine products for exports, Ganapathy (1978) indicated that apart from prawns there were number of other rich fishery resources available in our waters

which were yet to be tapped for export purposes. The excessive dependance on shrimp and few other items alone may result in closure of factories, once the export market crashes. So there is urgent need for diversification of marine products. Analysing the exports of marine products in different forms, Rao (1983) also suggested alternative forms of fish exports which should be explored to sustain the past rate of growth in view of decline in shrimp landings. He also suggested various promotional activities to develop markets for new products.

The review of literature reveals that studies relating to economic aspects of the marine fisheries of our country were not many and most of them were conducted at selected centres and at micro level. They could not help much in deriving policy perspectives either at State or national level. The noteworthy micro level studies carried out in our country was the economics of artisanal and mechanised fisheries in Kerala by Kurian and Wiliman (1982) in the production sector and a fish marketing study covering all maritime States of India by IIM. Ahmedabad. Both studies were not conducted with adequate data base. Fisheries economics has emerged as an important subject only recently in the Indian context. Hence, the present study on production and marketing management of marine fisheries in Kerala can be considered as a pioneering attempt. in his newly developing industry.

Exclusive Economic Zone (EEZ) of India

For centuries the basic claim by nations to exercise authority over marine fisheries insisted that access to them must be open to all beyond a narrow belt of national territory in the Ocean. Further many coastal States over the years insisted through unilateral legislation that the coastal state could lawfully extend some degree of control over living resources beyond national territory. However. the first United Nations conference on the Law of the Sea (UNCLOS) in 1958 and the second in 1960 were unable to agree on an extension of the territorial sea or an exclumsive fishery zone in the water column (Anderson, 1977). But these conferences left no doubt that a 3-mile territorial sea had little international support while a wider area of exclusive coastal control and preferential rights over fishheries met with widespread approval.

During the period following the 1958 conference until the beginning of the third UNCLOS conference in 1974, many countries extended their jurisdiction beyond the traditional 3 miles. The third UNCLOS held at Caracas estabilished broad and exclusive coastal state authority over fisheries within a zone of 200 nautical miles measured from the base line for the territorial Sea. The quality of "exclusiveness" in relation to authority over resources of the economic zone including fisheries is emphasised. The coastal States right in the zone are declared to be "sovereign" for certain specific purpose, namely exploring and exploiting, conserving and managing the natural resources, whether living or non living, of the sea bed and subsoil and superadjacent waters (William, 1983).

George et al. (1977) observed that all the 200 - mile Exclusive Economic Zone would constitute about 40% of the world oceans and that of 90% of the traditional fishing grounds and 70-80% of the global catch.

With the declaration of Indian Economic Zone, India had assumed not only exclusive jurisdiction, but also a great responsibility for the optimum exploitation of living and non-living resources in about 2 million km^2 . The 41st amendment to the constitution enacting "The Territorial Waters". Continental shelf. Exclusive Economic Zone and other Maritime Zones Act. 1976" came into force on the 25th August 1976. The Act defines the various Zones and the rights and jurisdiction in respect of these zones. The limit of the "Territorial Water" extends to a distance of 12 nautical miles from the appropriate base line. The sovereignity of India extends to these waters with the right of innocent passage for all foreign ships, but only with the Government's permission for foreign warships.

As per the classification the area beyond and adjacent to the territorial waters and extending to a distance of 24 nautical miles from the appropriate base line shall form the "contiguous Zone". The Government of India had full jurisdiction in this area to take measures with regard to the security of the country in immigration, sanitation, customs and other fiscal matters.

The "continental shelf" extends to the outer edge of the continental margin or to a distance of 200 nautical miles from the appropriate base line. In this area. India had sovereign rights for

exploration, exploitation, conservation and management of all resources. The Exclusive Economic Zone is an area beyond and adjacent to the territorial waters with a limit of 200 nautical miles from the base line. In addition to the rights mentioned for continental shelf. India will have sovereign rights for producing energy from tides. winds and currents and such other rights as recognized by international law.

The maritime boundaries between India and other countries adjacent to it shall be determined by mutual agreement. Pending such an agreement, the maritime boundary between India and such countries shall not exceed beyond the line which is equi-distant from either coast line. The area under Exclusive Economic Zone works out at 2.02 million Sq. Km comprising of 0.86 million Sq.km of the west coast, 0.56 million Sq.km off the east coast and 0.60 million Sq.km around the Andaman and Nicobar Islands (George et al.. 1977). The Indian EEZ would thus represent about 2.8% of the surface area of the Indian ocean (excluding Antarctic).

Global fisheries and management

The extension of fishery jurisdiction by most of the maritime States was the dominant event in global fisheries during the seventies. These extensions changed the open access regime to an extended jurisdiction of fisheries management. World fisheries have changed drastically since 1960. when annual landings and fishing industries were

growing rapidly. Now, growth appears to be virtually stagnant, despite dramatic changes in coastal State jurisdiction (FAO, 1981). Under the open access regime, the coastal State had little management control over the stocks of fish. Fishing was accompanied by considerable economic waste, many species were overfished or depleted to historically low levels of abundance, fishing in the distant waters of coastal States diverted economic benefits away from those States, and hence the capability and effectiveness of fishery management organisations became a matter of global concern.

In 1970 the annual increase in the global fish catches that had been obtained in earlier years had diminished considerably. Brain (1983) points out that the stabilisation of the global catch required the notion, that those stocks that comprised the catch had to be utilized with greater efficiency than they had in the past. The efficiency could only be increased through improved management of the extended jurisdiction region. However, the anticipated benefits could not fully be realized. To be sure, distant water fishermen were driven from their traditional grounds off the coastal States or charged fees for the right to fish in the extended jurisdiction zones, but other than this, wherever active management was attempted, it did not appear to work well; many of the old problems of management under the open access regioon remained and new ones were developed. He further indicates that in the absence of hard data on the economic performance of management, people haggled over boundaries, over objectives, over quotas, over the right to fish, over what optimum yield meant, over data and even over whether fishery management was a worthwhile enterprise. Further, the applicability of standard management procedures, particularly to multiple-species fisheries was challenged,

and it became apparent to many that traditional approaches to enforcement of regulations was not cost-effective. (Barber and Taylor, 1990).

It was usually assumed that catching more fish was all that was needed. and and if a defined objective was needed, then Maximum Sustainable Yield (MSY) was good enough. More recently the weakness of MSY has been pointed out, at first mainly by economists, who stressed the importance of looking at the net economic yield and the question of costs (Scott. 1955) and later biologists became concerned with broad interests of conservation (Holt and Tabbot. 1978)

First beginning with Gordon (1954) and Scott (1955) economists have identified the over exploitation of marine fisheries as an unregulated common property problem. Then the thrust has been on "optimal" management models for the ocean fisheries in which socially optimal or efficient policies for resource exploitation are delivered (Carlander, 1969). Achieving rational management in the ocean fishery had become more difficult with the mounting competition among fishermen for this valuable yet limited marine resources.

Open access fishery and Policy prescription

Reviewing in chronological order to quote Crutchfield and Zellner (1962) "if we may assume that market prices for goods reflect with reasonable accuracy the preferences of consumers, the basic economic objective from the standpoint of society, is to see the fisheries maximise net economic yield - the difference between the aggregate money value of output and the aggregate money cost of input needed to produce it.

The overall goal is elaborated upon by noting five important areas where the fishing industry should. according to Bromley and Bishop (1977) be judged like any private enterprise: (i) output and factor allocation, (2) efficiency in the narrower sense of cost minimization, (3) progressiveness in technology, (4) Income distribution and (5) stability. The Criterion concerning income distribution (Crutchfield and Zellner. 1962) is particularly relevent. "Returns from fishing should be distributed among participants on a basis that approximates their contribution to production. This requirement implies that income to labour and capital should be equal to those they could earn in other occupations. A level of fishing effort based on exploitation of the inability of fishermen or vessel owners to move freely to other activities would not necessarily be optimal even if other requirements are met".

They propose a system of progressive reductions in the number of licenses through competitive bidding. A tax on fish is also suggested. This system, they suggest, would achieve several desirable results including economic efficiency, improved technology, keeping the most skilled fishermen on the fleet, and placing the burden of risk for price and cost changes in the governments involved.

The study by Christy and Scott (1965), though it focuses on the world ocean fisheries rather than a specific fishery, is much more practical and policy-oriented than theoretical. The goal of economic efficiency can be approached by preventing excessive entry into the industry, so that those who fish would be producing the maximum economic revenue (to be shared among them or appropriated by the public) and so that those who are prevented from participating will be able to produce other goods and services valued by the community.

Bell (1972) has studied the U.S. northern lobster fishery. In discussing the objectives of fishery regulation, he notes "The optimum management strategy for any fishery is to permit effort to expand to the point where the marginal cost of the resources (capital and labour) needed to produce a pound of fish is equal to the price consumers are willing to pay for that last pound of fish".

Gates and Norton (1974) have also pointed out that the limitation of entry to the level of effort which produces maximum economic efficiency. The maximum economic efficiency is defined as that position where price equals marginal cost. They also estimated that the difference in fish products available to consumers would not be very much less under limited entry than under open access.

To the extent that economists can agree that a more equal distribution is to be preferred, this would raise serious questions about much of the literature in Applied Fisheries Economics. Consider, for example, the emphasis one often finds on limiting entry to minimum number of the most efficient units. If the Crutchfield - Zellner (1962) definition of efficiency is used, it is quite possible that those units which are permitted to fish will also be those with the greatest capacity to earn income outside of fishing while those excluded would have fewer income earning possibilities outside fishing. Even where the opportunity cost concept is used as the basis of analysis, potential future fishermen excluded under entry limitation may be highly immobile compared with those who achieve entry.

Hence, limitation of entry on the basis of efficiency might well encourage greater inequality. Production function and cost functions are directly influenced by other decision-making units. For the design of practical fisheries management policies, the language of the Marine Fisheries Conservation Act of 1975 (the extended jurisdiction legislation is relevant (Anderson. 1977). To quote section 304. "Any fishery management plan prepared by any council may

1. Designate zones where and designate period when, fishing shall be limited, or shall not be permitted or shall be permitted only by specified vessels or with specified gear.

2. Establish a system under which access to the fishery shall be limited in order to achieve Optimum Sustainable Yield (OSY) on a basis which may recognise, among other consideration, present participation in the fishery or fisheries, historical fishing practices and dependence on the fishery, value of existing investments in vessels and gear, capability of existing vessels to engage in other fisheries, history of compliance with fisheries regulations imposed pursuant to this act and the cultural and social frame work in which the fishery is conducted".

After providing a brief discussion of the concept of MSY as a management objective, the House Report turns to a discussion of the optimum sustainable yield (OSY). Again to quote. "Once the MSY of the fisheries or stock has been determined.....the developer of a management plan can begin to think in terms of the OSY. Thus, while biologists in the past have tended to regard any unused surplus of fishery as waste, the resource manager may well determine that a surplus harvest below MSY will ultimately enhance not only the specific stock under management, but also the entire biomass.....The

concept of OSY is, however, broader than the consideration of the fish stocks and takes into account the economic well-being of the commercial fishermen. the interests of the recreational fishermen. and the welfare of the nation and its consumers. The OSY of any given fishery or region will be carefully defined in order to respond to the uniquei problems of that fishery or region".

MULTIPLE STOCK EFFORT DISTRIBUTION

In a free access fishery consisting of a number of separable grounds, stocks or stock complexes, those yielding higher rents tend to draw effort, disproportionately, at the expense of those yielding lower rents (Anderson, 1977; Andrew, 1990). This results in a non-optimal distribution of effort from the stand point of rent maximisation. Of course, in free access fisheries effort tends to expand until eventually resource rent is dissipated in respect of all stocks. However. it is also noteworthy that during the process of expansion in a new fishery before all rent is dissipated there is misallocation of effort towards the stocks yielding the higher rents per unit of effort. The prawn fishery of some of the centres in Indian Coast illustrate this phenomenon well. The rich prawn stocks are heavily fished during the high season when the prawns are spawning. But relatively little interest has been shown in the less rich mixed stock of the top end have remained largely unexploited.

It may also be speculated that the best returns will be earned only if the fishery is conducted at a high enough level of effort to utilise available scale economics (e.g. in prawn searching, vessel

servicing and processing). Fishing units are attracted to the higher rent stocks (prawns) as long as average returns (catch per unit of effort (CPUE) from those stocks are greater than from less rich stocks (Gordon, 1954). Yet, to the fishery as a whole, marginal returns per unit of effort on the richer stocks may have fallen to zero or have turned negative.

In analytical terms, each boat operator chooses to join the trawl fishery, because average returns (CPUE) are higher than in the other techniques of fishing. But, considering the fishery as a whole, marginal returns in prawn fishery are lower than what they would be in other fisheries, so that aggregate returns for the units do not achieve their potential maximum.

Small-scale fisheries in India

Swaminathan (1981) pointed out four major points of distinction between small-scale and large-scale fisheries. First is that the human beings play a much more important role in small scale fisheries than in large scale fisheries. Second is capital input, where small-scale fisheries are labour-intensive and large-scale fisheries are capital-intensive. The third distinction is an ecological one associated with environmental pollution and related repercussions in large scale industries. The fourth is in the kind of energy used. The small-scale industries use the recycling or renewable type of energy. In large scale industries more and more energy of non-renewable type is used. According to the Expert Consultation Committee on Small-scale Fisheries Development of FAO (1980), "Small-scale fishheries refer to that sector of fisehries which is labour-intensive and is conducted by artisans

whose level of income, mechanical sophistication, quantity of production, fishing range, political influence, market outlets, employment and social security and financial dependence keep the fishermen subservient to the economic decisions and operating constraints placed upon them by those who buy their production".

Saxana (1983) indicates that the two terms of small-scale and large-scale fisheries are highly relative and are determined by technological, economic and social parameters. For simple and statistical purposes small/traditional/artisanal fishermen in India may be defined as those fishermen who are owning and or operating non-mechanised boats while those who own and or operate mechanised boats may be categorised as medium fishermen.

Under marine fisheries, inshore fishing, off-shore fishing and deep-sea fishing could be specified and various authors have discussed the same (Silas et al., 1976; Sudersan and Joseph, 1978; Mathai, 1983). Inshore Fisheries refers fishing in inshore waters upto 20 . depth from the coast. Fishing operations in these areas are mainly conducted by employing small fishing boats which are mechanised. Offshore fishing denotes fishing in the area between 20 and 80m depth, which is done mainly by mechanised fishing boats, which are made of wood and vary from 8 to 16 m in overall length. The boats are equiped with oil engines.

Deep-sea fishing indicates the exploitation, of fishing resources beyond 80m. For this purpose the boats have to be larger in size, because they are required to undertake fishing voyages of 7 to 10 days duration. The vessels are made of steel and normally exceed 16m in overall length, and are equipped with engines of 200 HP and above.

RESOURCES ESTIMATION BY ACOUSTIC SURVEY

The living resources of the sea are subject to depletion due to continuous and over-exploitation. Therefore, the knowledge of stocks, their distribution in space and time, migration, fluctuations in their abundance, and annual recruitment levels and optimum level of harvesting of resources is absolutely essential for proper planning and management. In recent days hydro-acoustic instruments such as echo-sounder, sonar, echo-integrator and trawl sonde are used to collect the required data in a systematic manner and for analysis of the same to provide reliable information on various aspects mentioned above for the effective management (Forbes et al., 1972).

Fish resoruces survey using the acoustic equipments is generally termed as "acoustic survey" which is considered to be far superior to the conventional "spot fishing survey" technique for the following reasons (Silas et al., 1982).

- This methodology is infinitely faster, since survey is done at a normal speed of the vessel and or larger area can be covered and sampled quickly.
- Acoustic surveying is carried out to probe the entire column all along the track whenever the vessel moves whereas a trawl survey is restricted only to trawlable ground corresponding to the depth interval swept by the gear.
- Wear and tear of the gear and fishing time is reduced, as fishing is done occassionally for indentification purpose only.

Considering its proven advantages as mentioned above the use of acoustic technology in modern fisheries research is becoming more relevant and important.

In India erstwhile UNDP/FAO/Pelagic Fisheries Project carried out extensive acoustic surveys from 1970 to 1978 for the important fish resources of the south-west coast of India and estimated their biomass (Olsen _et al._, 1977). Major fish resources responding to acoustic surveys by echo-sounder and echo-integrator in Indian waters are the column fish such as whitebaits, catfish, ribbonfish and horse-mackerel, etc. (Natarajan _et al._, 1980). In the case of surface schooling fish such as oilsardine and Indian mackerel, sonar survey has been found to be more suitable acoustic technique for location and quantification (Krishna Rao _et al._, 1980). Acoustic surveys for fish resources are being conducted in Indian waters by FORV Sagar Sampada since 1985 (Natarajan, 1990). Also using the same acoustic equipments investigations on the Deep Scattering Layer (DSL) of the Indian EEZ was carried out, with special reference to euphausiids as a component (Mathew _et al._, 1990).

CHAPTER III

MATERIALS AND METHODS

Large number of fishermen, who are in the lowest rungs of the socio-economic ladder of the society, are engaged in marine fishing adopting various types of fishing methods suiting to different seasons and regions. Initially the choice of fishing techniques was governed only with the motive of simply collecting some food or earning a livelihood. The open entry possibility and the increase in demand for sea food converted the subsistence marine fishing activities into a highly competitive commercial venture.

For the purpose of economic evaluation of different types of marine fishing methods, the marine fishing sector has been classified into four distinct groups viz.

i) Nonmechanised artisanal sectors using country craft with traditional gears.

ii) Motorised sector using traditionoal craft with outboard engines of less than 50 HP.

iii) Mechanised sector using inboard engine of 50 to 120 HP.

iv) Deepsea fishing with bigger size boats (25 m and above) and engine power capacity of 120 HP and above. In each group all types of major fishing gear in vogue have been included in the economic evaluation of fishing operation.

The monetary returns received by the investors and labourers have become the guiding factor in the option of any fishing technique.

The growth and development of marine fisheries is further linked with internal and external marketing of fish and infrastructure facilities connected with the main and subsidiary sectors. Hence, the extensive data on production and marketing aspects with wide coverage is very essential to evolve proper policies for planning and management of this sector.

Both primary and secondary data have been collected and used in the present study. The capital inputs towards initial investments and operational costs widely vary between different types of fishing methods and also between different places. Further, even for the same type of fishing unit. Operational costs vary not only betweeen different units, but also for the same unit for different trips. Hence, continuous monitoring of the costs and earnings of a particular type of fishing units atleast for an year covering all fishing seasons is very essential to work out various parameters of fish production. Fish marketing also involves lot of intermediaries from the producer at fish landing centres to the consumers in retail markets. The perishable nature of fish and consequent urge for quick supply to long distances within minimum time , preservation, storage, processing, transportation and the nature of passing throughh many hands before reaching the ultimate consumer make any fish marketing study meaningful only by collecting data at all stages of the marketing channel. Since the data on economic of production and marketing of marine fisheries are very much limited, primary data have been collected from selected sample centres of Kerala Coast to supplement the secondary data.

Sources of Secondary data

Acquisition and dissemination of data connected to marine fisheries development is being done continuously by various agencies. The Central Marine Fisheries Research Institution (CMFRI), Kochi; National Institute of Oceanography (NIO) Goa; Central Institute of Fisheries Technology (CIFT), Kochi; Fisheries Survey of India (FSI), Bombay and Marine Products Export development Authority (MPEDA), Kochi are some of the leading organisation engaged in the promotion of R & D, exploratory fishing and international trade in marine fisheries. Besides, the Directorate of Fisheries, Kerala also provide good published data on various aspects of marine fisheries in the State.

The biological and oceanographic data wherever necessary for the present analysis have been collected from the publications of the above organisation. The data with regard to the present exploitation of marine fishery resources along Kerala Coast (Time series, gearwise, centrewise, etc.) have been collected from the National Marine Living Resources Data Centre (NMLRDC) of CMFRI. The information relating to the updated census of marine fisheries published by the Directorate of Fisheries, Kerala and the export marketing data by MPEDA over the last few years have been obtained and extensively used for the present study.

Primary data

Although a good deal of secondary data on marine fisheries in Kerala is available, it appears to be not sufficient for any meaningful

economic analysis. Hence, it has been supplemented by primary data, collected under a suitable sampling design. Data on costs and earnings of different craft - gear combination and price of different varieties of fish including handling and transportation charges at various points of the marketing channel covering all seasons for a period of one year have been collected by direct contacts at selected centres.

Different craft - gear combinations prevalant along Kerala Coast have been identified. Traditional sector comprising both the motorised and non-motorised catamarans and plank-built boats, have innumerable technological options as various types of gears can be operated depending upon its suitability according to seasonal as well as spatial variations in relation to catch abundance of certain species. Sample units representing different craft - gear combinations in artisanal, motorised and mechhanised sector at different landing centres have been randomly selected for continuous observation. Similarly for studying the marketing efficiency, the data on price at landing centre, wholesale market and three retail markets have been regularly collected twice in a week continuously for an year from April 1992 to March 1993. Three types of schedules were designed, tested and then used for this study.

Schedule I is for collecting general information of landing centres and fixed cost details of craft - gear combinations (Appendex I).

Schedule II is for collecting data on the day to day operating expenses, species-wise catch and revenue from sample units (Appendix II).

Schedule III is for collecting the marketing data at different points in the marketing channel (Appendix III).

Artisanal Sector

Kerala occupies the first position in marine fish production in India, accounting for almost a quarter of the total landings of 1.6 million tonnes. About two-thirds of the marimne fish landings of the State was accounted for by the purely artisanal sector till the late seventies, even though mechanisation picked up as early as mid-sixities. This pattern is fast changing due to large-scale motorisation of country craft using outboard engines since 1980. While landings of motorised craft has substantially increased during the last ten years that of othe non-motorised showed a declining trend.

There are about 15,000 catamarans and 12,000 other types of country craft such as Dugout canoes, plank canoes and plywood boats (Non-mechanised) engaged in marine fishing along Kerala Coast. This is about 15% of the total non-mechanised units operating in all maritime States of India. Different types of specialised gillnets, hook and lines, shore seine, Thattumadi and Trammel net are the major gears operated by this non-mechanised sector. Sample units of catamarans operating sardine gillnets (Chalavala), Hooks and lines, Trammel nets and Thattumadi are observed throughout the year in the South Zone from Kollengode to Nendakara (Trivandrum and Southern Quilon District). Plank canoe with Koruvala (encircling net) and Gillnets (small) are observed in the Central Zone at Punnapra, Chellanam and Fort Cochin

(Alleppey and Southern Part of Ernakulam District). Dugout canoe using 'Kollivala', a boat seine operated by a pair of large dugouts and Gillnets are observed in the northern zone from Fort Cochin to Manjeswaram (Northern Ernakulam, Trichur, Malapuram, Calicut, Cannanore and Kasargode District). At each centre a sample of 20 units was randomly selected and data on initial investment, season-wise operational costs, species-wise catch and earnings have been collected for the peirod of one year.

Motorised Sector

Traditional craft such as plank-built boats, dug-out canoes and catamarans fitted with outboard engines are termed motorised craft (Balan et al., 1989). Here, human labour power is substituted by mechanical power for propulsion. Fishing continues to be carried out through human labour. Kerala saw a rapid motorisation of the artisanal fleet with the help of imported outboard Engine that run on kerosene since 1980. At present there are about 8000 motorised country crafts which is about 30% of the total traditional units. Motorisation is comparatively more in Calicut, Trivandrum, Alleppey, Malapuram and Kasargode Districts of the State. Cost and earnings data for 60 motorised units, 20 catamaran units each operating different gears have been collected for ten sample days in each month during the study year.

Mechanised sector

There are about 5026 mechanised units operating along Kerala Coast. More than 90% of them are trawlers. Quilon, Ernakulam, Cannanore and Calicut are the major centres of mechanised units. Data on costs and earnings of 60 sample units at Quilon, Ernakulam and Calicut are collected for 10 days in each month during the study year. Data on seasonal operation of mechanised boats at Vizhinjam (Trivandrum District) and Majeswaram (Kasargode District) also have been collected during April 92 to March 1993.

Analysis and interpretation of data

Suitable statistical and econometric tools were used in the analysis and interpretation of data. The average cost and earnings of different type of fishing units have been worked out on an annual basis. To evaluate economic efficiency of different craft - gear combinations, a number of key economic indicators such as rate of return, capital turn-over ratio, net operating income, profit, etc. have been worked out. The marketing margins and fisherman's share in consumer's rupee for about 22 varieties of fish were also calculated.

The Cobb-Douglas production function was used to find out the functional relationship of input and output for selected types of craft - gear combinations (Panikkar and Srinath, 1991). The model used is given as

$$Y = a.\ x1^{b1}\ x2^{b2}.x3^{b3} \quad .....xn^{bn}$$

Where Y is the output, x1, x2 .....xn are various inputs, b1, b2..... bn are elasticities of production of their corresponding inputs and 'a' is a constant.

The Marginal Physical Product (MPP) was calculated as

$$MPPx = b.\ \frac{\bar{y}}{\bar{x}}$$

Where MPPx is the marginal physical product of x, b is the elasticity of production of input x ; $\bar{y}$ is the mean level of output and $\bar{x}$ is the mean level of input x used.

Economic efficiency dictates that the use of each unit of input (x) is at the level where the value of its marginal product (MVPx) equals its unit cost (Px).

i.e MVPY = Px

where, MVPy is the value of the marginal product of y and Px is the unit price of x.

If MVPy is greater than Px the amount of input used is to be increased and if MVPy is less than Px, then the amount of input should be reduced to maximise profit.

To compute price spread (by concurrent method) the gross marketing margin (GMM), percentage of marketing margin (PMMCR) and percentage share of fisherman (PSFCR) are calculated as follows :

$$GMM = RP - LP$$

$$PMMCR = (RP-LP)x100/RP$$

$$PSFCR = LP \times 100/RP$$

Where RP denotes average retail price and LP that of the landing centre price.

Since correlation coefficient is the commonly used measure of pricing efficiency and market integration in developing countries (Blyn, 1973; Harris, 1979; Lundal and Peterson, 1983; Naik and Arora, 1986), in this study also the same has been used.

CHAPTER IV

GENERAL PROFILE, FISHING CENTRES AND ACTIVITIES

The State of Kerala, a narrow strip of lush green land bounded on the east by western ghats interspreaded with rivers and on the west by the Arabian Sea, north by Karnataka and south by Tamil Nadu is situated between 08^{o} 18'N and 12^{o} 48' N and 74^{o} 52' E and 77^{o} 22' E of the Indian peninsula.

Kerala has a coast-line of 590 km, less than one tenth of the Indian Coast and contributes 30% of the total marine fish landings of the country. The coastal waters of the region is comparatively rich and the potential yield upto 0-50 m depth has been estimated at 0.57 million tonnes using Relative Response Model (Anon., 1991). The continental shelf of this coast is about 40,000 km^2.

Fish and fisheries play a pivotal role in the economy of the inhabitants of coastal folk. In Kerala, about 1.48 lakh active fishermen and an equal number are presently engaged in fisheries and its allied activities such as processing, marketing, etc. and generate a lot of money apart from export earnings. About two thirds of the marine fish landings of Kerala was accounted for by the artisanal (Plate IV - Ia) sector till 1979. Mechanisation was experimented in late fifties under the Indo-Norwegian project by introducing trawlers (Plate IV - Ib). The early sixties witnessed an important technological development in gear, the shift from cotton to nylon nets. Commercial purse-seining started during the late seventies.

During midfifties motorisation of country craft was tried under Indo-Norwegian project. During 1979-80, the fishermen of the fishing village Kannamaly (Ernakulam District) successfully carried out the motorisation of the country craft, which attracted the attention of the fishermen of other regions also. Soon, motorisation programme gained momentum in Kerala.

Kerala State consists of 9 coastal districts viz., Trivandrum Quilon, Alleppey, Ernakulam, Trichur, Malapuram, Kozhikode, Cannanore and Kasaragod (Fig IV-1). There are 5026 Mechanised (Trawlers, Gillnetters and Purse seiners), 7934 motorised and 27104 nonmechanised Fishing crafts consists of plank-built boat, Dug-out canoes and catamarans in operation along Kerala Coast, (Sathiadhas et al., 1995). Fishinng gears operated are trawl nets Purseseines, Drift / gill nets, Boat seines, Hook and lines, shore seienes, traps, scoopnets etc. Kerala has 222 fishing villages and 226 fish landing centres. The activities in the different fishing centres are explained below district wise from north (Kasaragod) to South (Trivandrum).

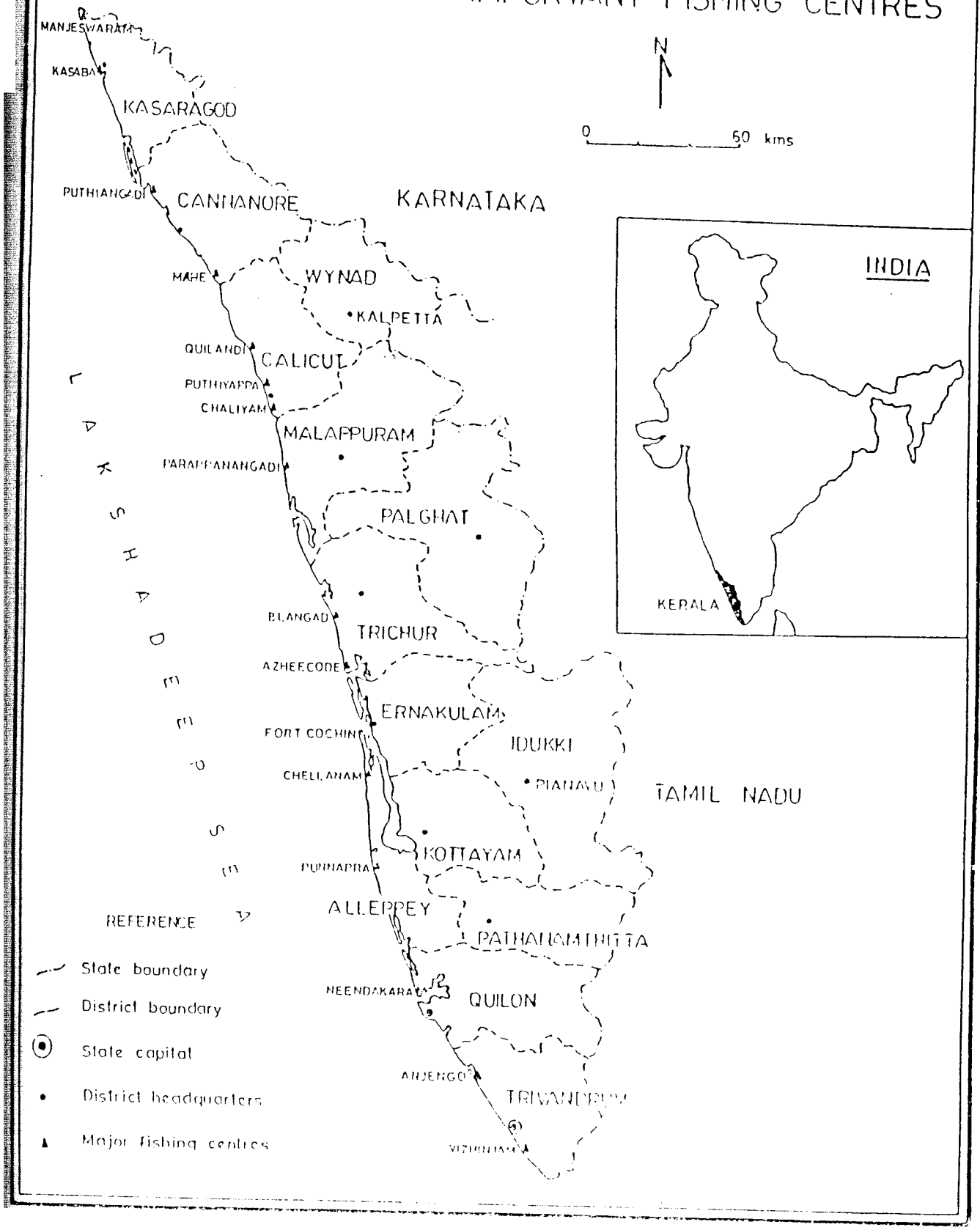
KASARGODE

The coastal area of this district (Fig IV-2) which borders the Karnataka State is picturesque with a number of river mouths and long stretches of uninhabited virgin beaches between fishing villages. The density of fishermen population is generally low. The main fishing operation in the artisonal sector is that of the ring seine, used with three or four large dugout canoes.

Figure IV-1

K E R A L A

IMPORTANT FISHING CENTRES



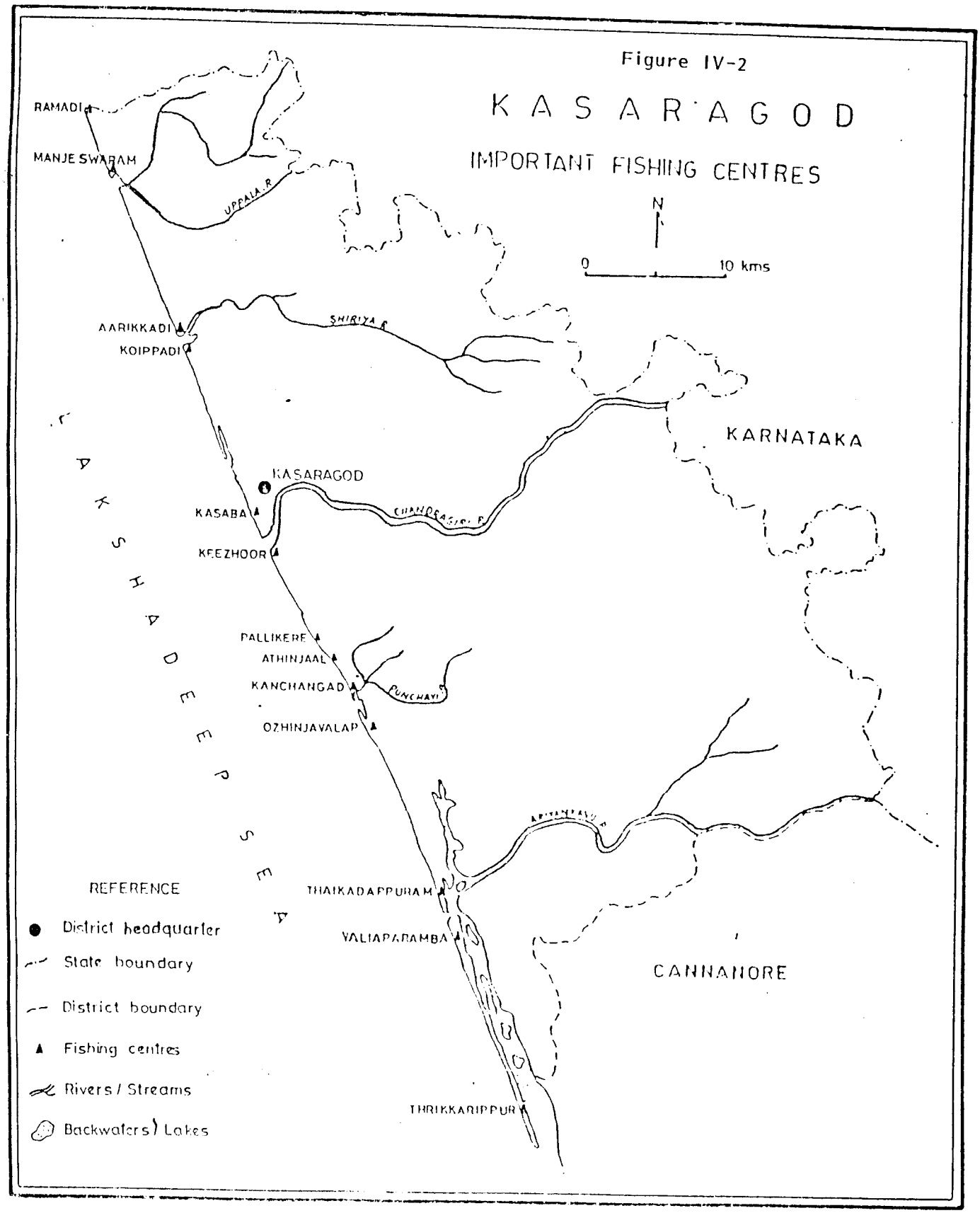


Figure IV-2
KASARAGOD
IMPORTANT FISHING CENTRES
N
0
10 kms
RAMADI
MANJESWARAM
UPPALA R
AARIKKADI
KOIPPADI
SHIRIYA R
KARNATAKA
KASARAGOD
KASABA
CHANDRAGIRI R
KEEZHOOR
PALLIKERE
ATHINJAAL
KANCHANGAD
PUNCHAVI R
OZHINJAVALAP
ARIYANKAVU R
THAIKADAPPURAM
VALIAPARAMBA
CANNANORE
THRIKKARIPPUR
ARABIAN SEA
REFERENCE
District headquarter
State boundary
District boundary
Fishing centres
Rivers / Streams
Backwaters / Lakes

In general, the district has very few non-motorised craft, most of them small dugout canoes in Manjeswaram, Koippady and Keezhoor. There are also a handful of very small nonmotorised dugouts used mainly for mussel fishing. The traditional hook and line operations ("Beppu choonda") are conducted by the Muslim fishermen of Manjeswaram. The ring seines units are largely owned by groups, while the gillnet units are individually owned.

The fishermen of Kasargode are basically Hindus with small poockets of Christian and Muslim fishermen also in existence. The most important traditional regulation relates to the operation of the gillnet units (medium dugout canoes). These units are not expected to operate from the first week of June till the end of October when it is the peak season for the larger dugouts with ring seines (earlier the Kollivala). This appears to be some kind of an attempt to ensure that labour is available for the larger craft during peak season.

After Trivandrum and Quilon, Kasargode appears to have the largest number of fisherwomen involved in fish handling and marketing. Fish marketing in nearby markets is generally done by the fisherwomen while the rest of the catches going to distant markets are handled by merchants. Pallikere is known for the "chakara" (mudbank phenomenon) during the monsoon months and many units operate from other parts of Kasargode from here if the chakara is formed.

CANNANORE

Cannanore District (Fig.IV-3) has also a fairly low density of active fishermen. But most of them are concentrated around Puthiyangadi, Cannanore city and Tellicherry.

The rani vala operations have completely displaced the older kollivala units during the last couple of years. The rani vala is better known locally as the "kudukku vala".

A variety of gillnets are used with small and medium dugout canoes. Very small dugouts with a one-man crew are used in a few locations for mussel fishing. Lobster nets are in use with small dugouts in some of the centres in view of the rocky bottom that characterises the sea in parts of the district. The traditional hook and line ("Beppu choonda") is carried out off Cannanore.

The fishermen of the district are both Hindu and Muslim with the Muslim in the majority in the northern part and Hindus in the majority in the southern part. While ownership of units is more widespread in the Hindu community, it appears to be more concentrated in the Muslim community. Many Muslim merchants own craft and gear and get migrant labour from the south to work as crew.

Tellicherry is famous for dry/salt fish trade and a few big merchhants dominate the market which attracts fish from long distances. Mechanised boats operate mainly from Azheekal at the mouth of the Valapatanam river or from the fishing harbour at Cannanore city.

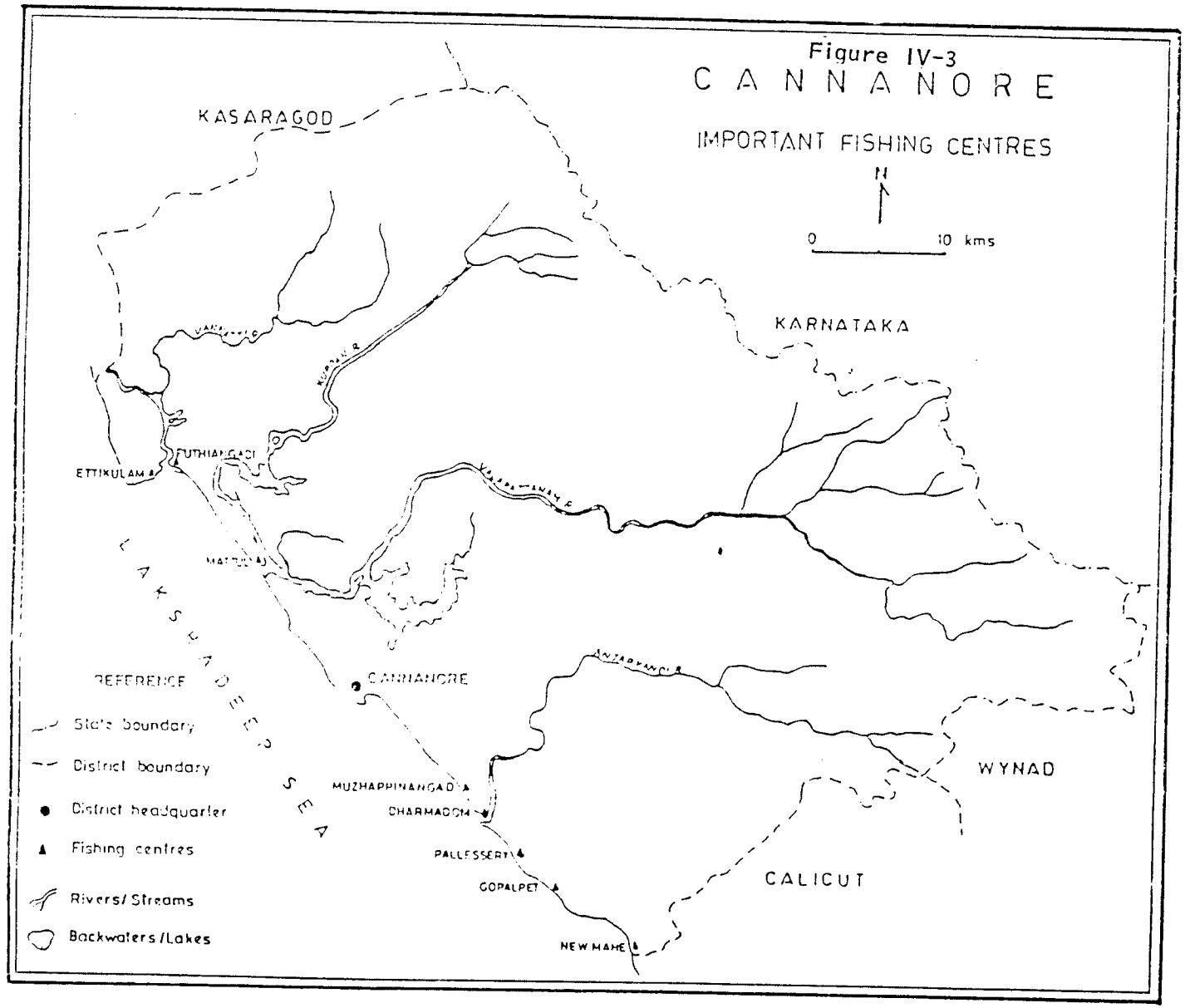


Figure IV-3
CANNANORE
IMPORTANT FISHING CENTRES
N
0
10 kms
KASARAGOD
KARNATAKA
WYNAD
CALICUT
CANNANORE
ARABIAN SEA
MUZHAPPINANGAD
DHARMADOM
PALLESSERY
GOPALPET
NEW MAHE
REFERENCE
State boundary
District boundary
District headquarter
Fishing centres
Rivers/ Streams
Backwaters/Lakes

CALICUT

In the whole of the northern region (Vypeen to Manjeswaram) the coastal area of Calicut district (Fig. VI-4) appears to be the most densely populated. It was in Calicut that the final battle between the ring seine and the kollivala (boat seine) was fought during mid-1990 with the latter getting completely eliminated.

At the river mouths, castnet fishing takes place on a large scale. Mussel fishing is also quite extensively done in the district. Calicut has also the largest number of shore seines (used with dugouts) in the northern region.

Chaliyam and Badagara are most prominent for large mesh driftnets, while in many other centres, this gear is used in smaller numbers. Hook and line fishing (traditional "Beppu Choonda") is done at Badagara, Palli, Elathur, Puthiyakadavu and Chaliyam. Elathur is particularly, well known for shark fishing with hook and line.

Mini-trawl net operations using a medium dugout and 8 HP motor is quite prevalent with Chombala, Kuriyadi and Chaliyam having large concentrations. The mini-trawl is basically a diversification for dugout medium units which during other seasons operate gillnets. In the belt where the thanguvalloms operate, the medium dug outs also operate as carrier boats during peak season and get as much as 20-25% off the share.

Chombala, Badagara, Quilandy, Puthiyappa, Puthiyangadi and Beypore are the major landing centres, though fish is landed in many of the other locations also. Quilandy is probably the largest landing centre for artisanal fishermen and it is famous for its annual "chakara".

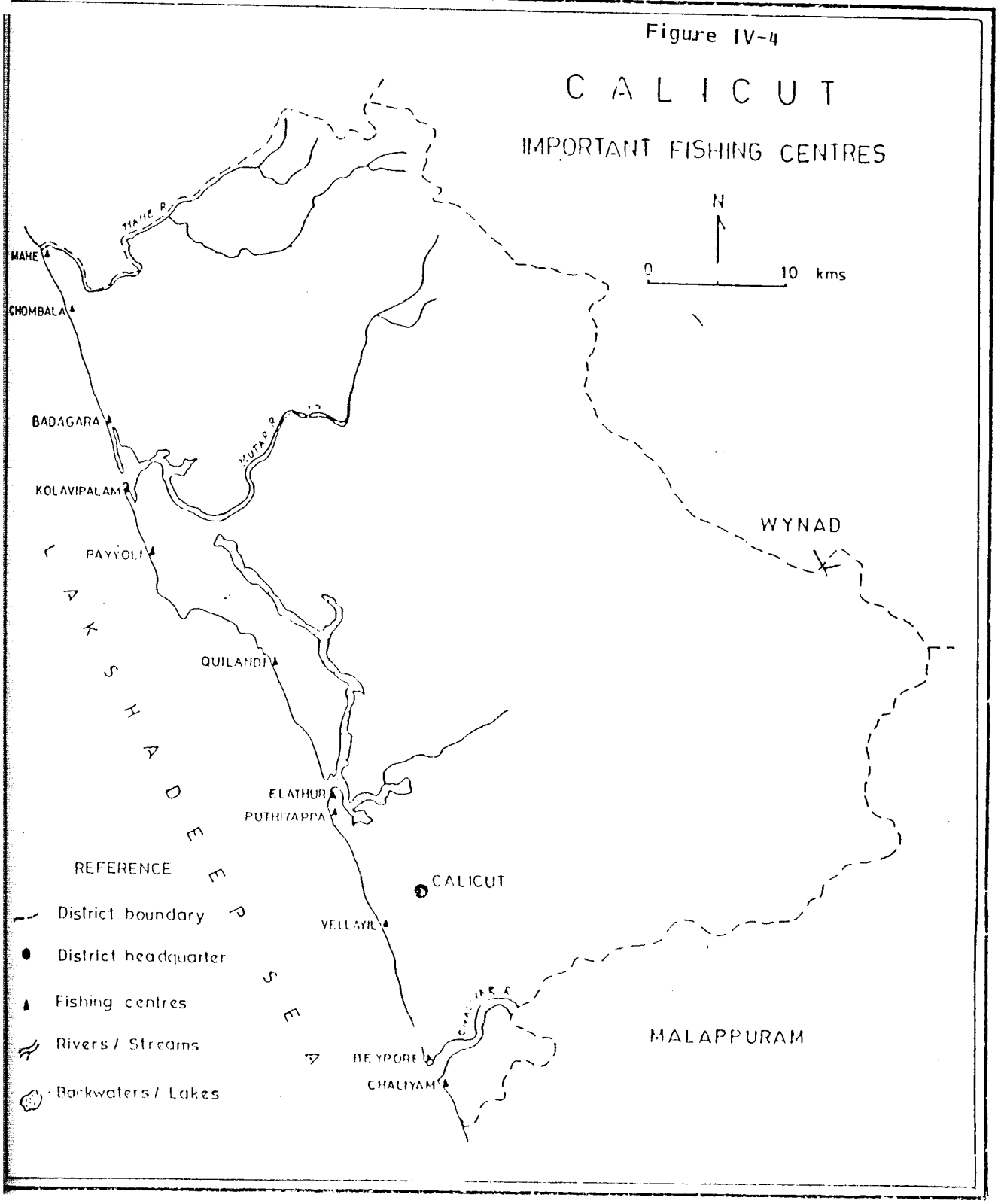


Figure IV-4
CALICUT
IMPORTANT FISHING CENTRES
N
0
10 kms
MAHE
CHOMBALA
BADAGARA
KOLAVIPALAM
PAYYOLI
QUILANDI
ELATHUR
PUTHIYAPPA
CALICUT
VELLAYIL
BEYPORE
CHALIYAM
WYNAD
MALAPPURAM
ARABIAN SEA
REFERENCE
District boundary
District headquarter
Fishing centres
Rivers / Streams
Backwaters / Lakes

Fishermen tend to choose landing centres according to surplus quantity available and price. It is not uncommon for a fishing unit to have advances from middlemen in more than one landing centre.

The fishermen population is more or less evenly balanced between the Hindu and Muslim communities. Most villages have both communities living together, though there are a few villages which are 100 Percent Hindu (Kollam, Virunnukandi and Puthhiyappa) or 100 percent Muslim (Badagara, Palli and Thekkekadappuram).

The presence of mechanised trawlers is quite strong in Calicut, with large numbers anchored at Beypore and Puthiyappa.

Mahe is a fishing village on the Calicut-Cannanore District Border, which belongs to the Union Territory of Pondicherry (headquarters is at Pondicherry on the East Coast). The Mahhe fishermen operate side-by-side with the Kerala fishermen in the same fishing grounds. In fact, the Mahe fishermen, land most of their fish in Kerala (Tellicherry, New Mahe or Chombala).

MALAPURAM

This Muslim majority district (Fig. IV-5) was a great revelation. In just a couple of years (1988-90) it has found the resources to replace in toto the dugout canoe - kollivala combination with the large plank canoe - ring seine combination.

The medium dugout operations also appear to be thriving with diversified operations, using gillnets, mini-trawl and "vattavala" (a boat seine). During certain seasons, these units also double up as carriers for the ringseine units getting 25% of the catches as share.

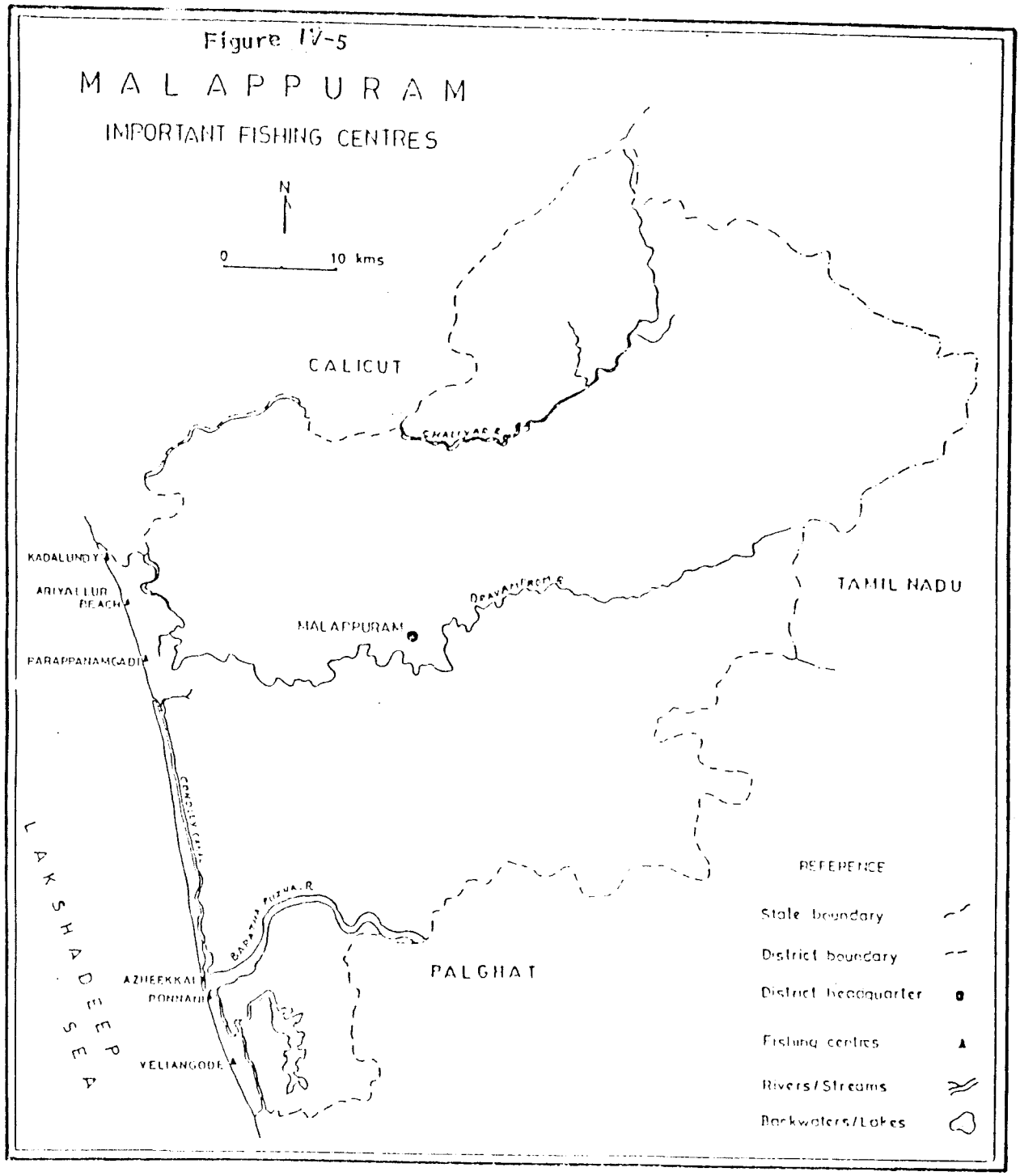


Figure IV-5
MALAPPURAM
IMPORTANT FISHING CENTRES
N
0
10 kms
CALICUT
KADALUNDY
ARIYALLUR BEACH
PARAPPANAMGADI
MALAPPURAM
TAMIL NADU
PALGHAT
AZHEEKKAL
PONNANI
VELIANGODE
LAKSHADWEEP SEA
REFERENCE
State boundary
District boundary
District headquarter
Fishing centres
Rivers/Streams
Backwaters/Lakes

Another unique feature of Malappuram is the presence of the semi-dugout craft, which is used as an alternative to the medium dugout. Called "chemban thoni", this boat has a flat bottom which is generally carved out of a single log.

As mentioned, the fishermen of the district are almost entirely Muslims. A few Hindu fishermen live in some of the southern villages with only Azheekal having a sizable Hindu population (30%). The local social structure revolves around villages elders and the mosque committee. The families are large joint families, each headed by a patriarch. As in other districts, ownership of units other than ring seines are by individuals or more precisely, heads of families. But ring seines seem to be owned by groups.

The important fish landing centres in the district are Parappanangadi, Ossankadappuram (Thanur), Koottayi and Ponnani. Fishermen in the northern villages go upto Beypore (Calicut) for landing in certain seasons while fishermen in the south go upto Puthenkadappuram (Chavakkad, Trichur). Generally the marketing system appears to be similar to that of the rest of Malabar (middlemen control and large merchant operations).

Unniyal has become a haven for non-motorised Kattunmaran fishermen from Kanyakumari district and they use it as a base for 4-6 months. The local Muslim households seem to welcome with open arms these christian fishermen from the south and provide them paying guest accommodation for the season. Each migrant pays Rs.10 per day for boarding and lodging with local families. Depending on fish availability, the Kattumarans do shift to other centres further north, but Unniyal remains their home base for the period. Nearly 500

kattumarans and 1,000 fishermen come here during the season.

Mechanised fishing does not appear to be significant in Malappuram with Azheekkal being the only location with a significant trawler population.

TRICHUR

Prior to motorisation, Trichur (Fig. IV-6) was part of the dugout canoe belt, with two medium dugouts operating the kollivala as the main craft-gear combination. The reason why Trichur has not been able to operate both the old artifacts and the new (like in Malappuram) could be labour shortage. The fishermen density in this district is rather low.

Roughly, half of the operational medium dugouts are motorised and they use a number of small gillnets for sardine, mackerel and pomfret. The non-motorised dugouts also use similar gear. The "Vattavala", a boat seine operated by two dugouts, is still nominally in existence. Thalikulam seems to be the only place where large mesh driftnets are used, while Asheekode is the only place where the locals undertake hook and line operations.

Both Muslim and Hindu communities coexist on the coast. Generally, the villages in the northern part (Andathode to Engandiyoor) have a majority of Muslims while the rest of the area has a Hindu majority. The ownership of the ring seines are on group basis as in other districts. The group size varies from 10-20 in the northern part while the range is much greater in the south (10-40).

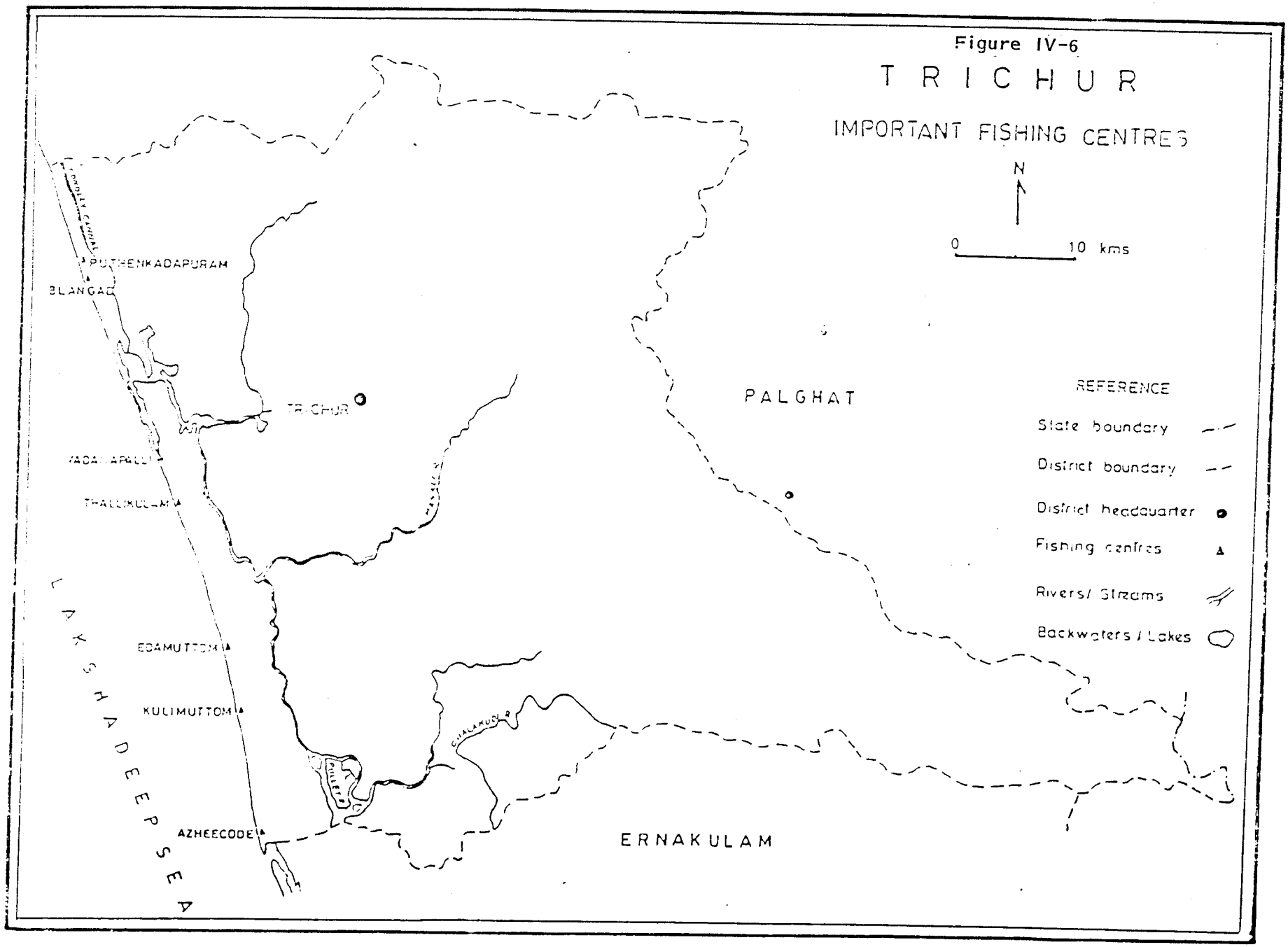


Figure IV-6
TRICHUR
IMPORTANT FISHING CENTRES
N
0
10 kms
REFERENCE
State boundary
District boundary
District headquarter
Fishing centres
Rivers/ Streams
Backwaters / Lakes
PUTHENKADAPURAM
BLANGAD
TRICHUR
PALGHAT
THALIKULAM
EDAMUTTOM
KULIMUTTOM
CHALAKUDY
AZHEECODE
ERNAKULAM
LAKSHADEEP SEA

Chavakkad (Blangad and Puthenkadappuram), Nattika, Kazheembram (Edamuttom) and Azheekode are the main landing centres in the district. Kazheembram is the most important centre during the monsoon period because of the regular occurrence of the "Chakara" or mud-banks. Local fishermen own trawlers in Blangad, Puthiyakadappuram and Azheekode.

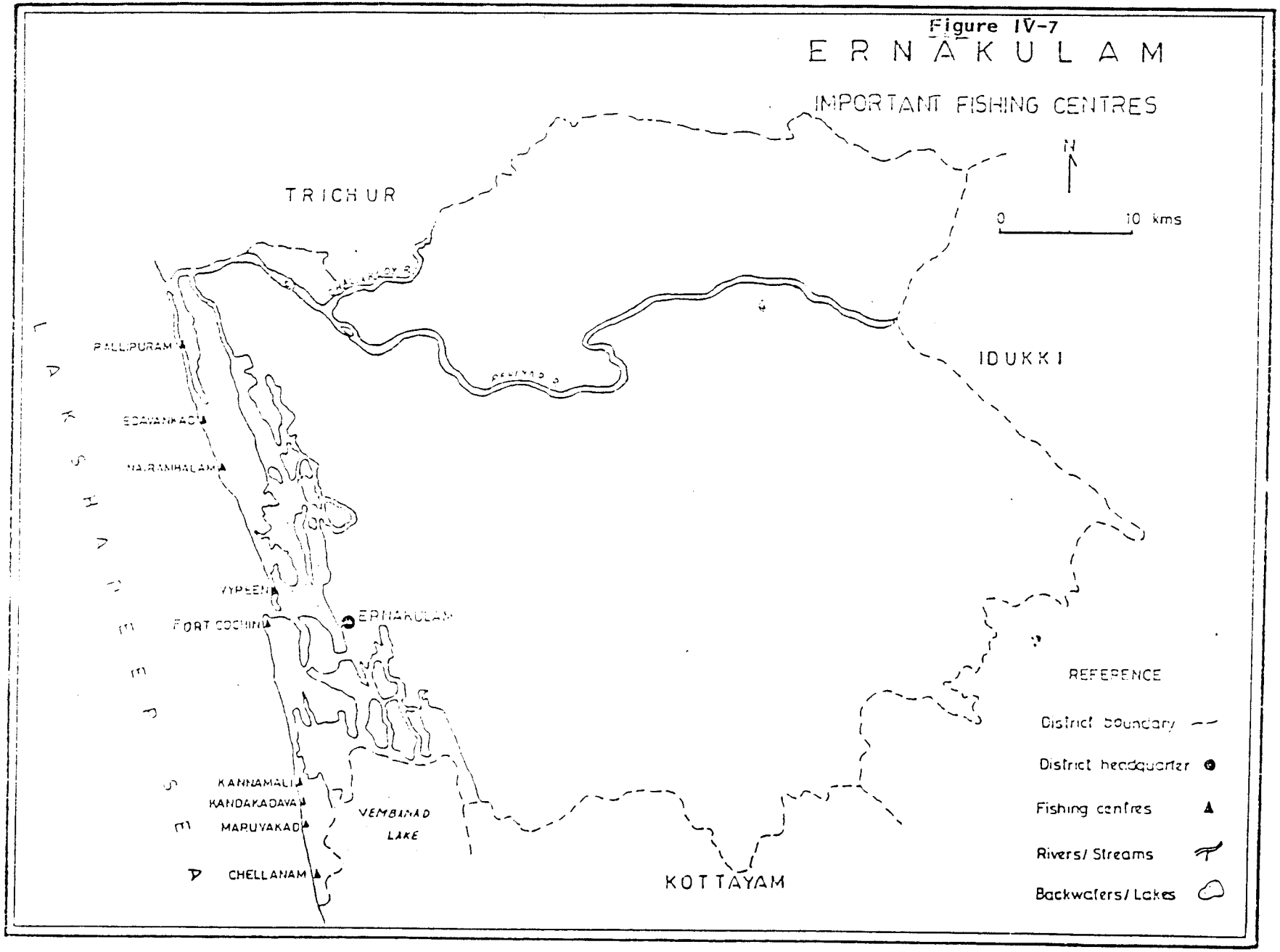
ERNAKULAM

Ernakulam district (Fig IV-7) traditionally was never a single entity, fisherywise. The southern part from Fort Cochin to Chellanam has been part of the plank canoe belt, while the northern part from Vypeen to Munmabam (Vypeen Island) has been part of the dugout canoe belt.

Another important feature of the district is the overlap between inland and marine fishing. Virtually all marine fishing villages in the district are within striking distance from one arm or the other of the Vembanad lake. As a result, most fishermen who operate small non-motorised craft (dugout in the north and plank in the south) often spend half the year fishing in the backwaters. Only in Fort Cochin it is found that the small canoes operate exclusively in the sea side. Chinese dipnets, which are used mainly on the lake sides are also present on the sea side at Fort Cochin.

The southern area is almost exclusively populated with Christian fishermen, while Hindus form the majority in the north. Ownership of the ring-seine units is generally by large groups of fishermen, ranging from 10-28. Soouthern Ernakulam was traditionally known for individual ownership of the erstwhile "kuruvala" units (unlike in Alleppey).

Figure IV-7


ERNAKULAM
IMPORTANT FISHING CENTRES
N
0
10 kms
TRICHUR
IDUKKI
KOTTAYAM
PALLIPURAM
EDAVANKAD
NAIRANIHALAM
VYPEEN
FORT COCHIN
ERNAKULAM
KANNAMALI
KANDAKADAVA
MARUVAKAD
CHELLANAM
VEMBANAD
LAKE
REFERENCE
District boundary
District headquarter
Fishing centres
Rivers/ Streams
Backwaters/ Lakes

During the monsoon months, all landings virtually take place in the Cochin fishing harbour due to the safe anchorage facilities. In the other months, fish landing takes place in each fishing village itself.

The mechanised sector has a dominant influence in this district. A large number of trawlers operate round the year from Cochin harbour as well as a few purse-seine units. In villages close to the harbour, a large proportion of the work force works on the mechanised boats and net mending (Plate IV - IIa and IV - IIb)

ALLEPPEY

It will not be an exaggeration to say that Alleppey district (fig. IV-8) is today the heart of Kerala fisheries and that the Alleppey fishermen have the most dominant influence on the artisanal sector. Over 40 percent of the ring seine units are concentrated in Alleppey. The chakara in Alleppey is more predictable and long-standing when compared with other districts. During the southwest monsoon (Jun - Aug), substantial amount of shallow water fishing takes place giving opportunity for smaller units to compete with larger units. In fact, during this period, there is actually a shortage of labour in some units.

There are over 150 units which operate with only the chooda vala. The chooda vala is best operated within 20 m and for smaller species, particularly the anchovy.

Gillnetting with small and medium plank canoes is widely prevalent, but large mesh gillnets found only in isolated pockets like Arthingal and Chettikad. Kattoor is famous for hook and line fishing.

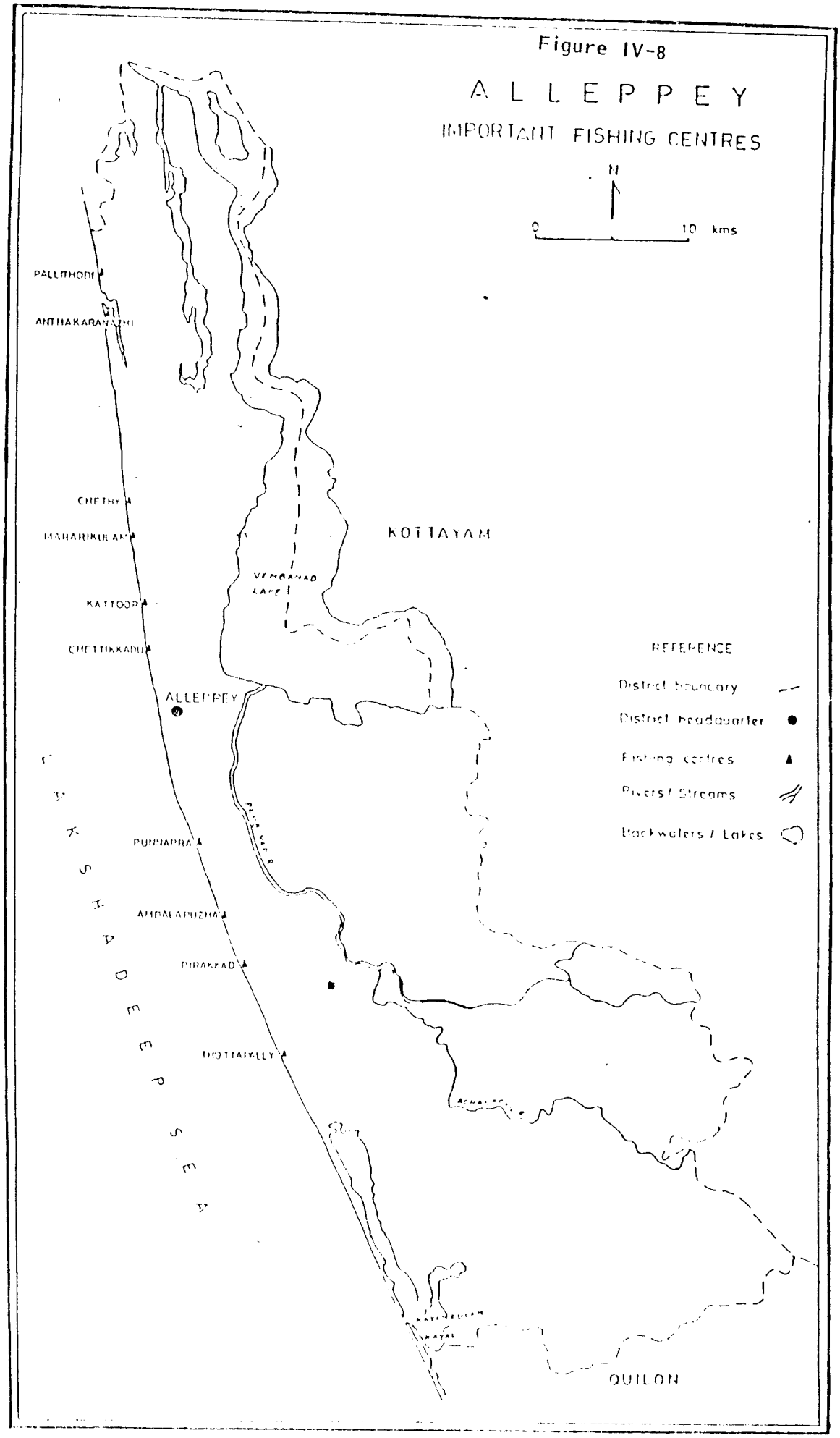


Figure IV-8
ALLEPPEY
IMPORTANT FISHING CENTRES
N
0
10 kms
PALLITHODE
ANTHAKARANAZHI
CHETHY
MARARIKULAM
KATTOOR
CHETTIKKADU
ALLEPPEY
KOTTAYAM
VEMBANAD LAKE
PUNNAPRA
AMBALAPUZHA
PURAKKAD
THOTTAPALLY
ARABIAN SEA
QUILON
REFERENCE
District boundary
District headquarter
Fishing centres
Rivers / Streams
Backwaters / Lakes

There is a widespread use of the mini-trawl using the plank transom boat.

The northern part of the district from Pallithode to Chettikad is populated exclusively by Christian fishermen. From Chettikad to Punnapra, the Christians are in substantial majority, but small numbers of Hindu fishermen also live here. South of Punnapra, it is almost exclusively a Hindu area, though with small pockets of Muslim fishermen.

Andhakaranazhi, Thaikkal, Chethy , Chennaveli, Punnapra, Ambalapuzha, Thottappally and Thrikkunnapuzha are the main landing centres in the district. During monsoon months, landing takes place only where the chakara forms. This normally takes place in two locations, Chethy or Chennaveli catering to the northern part and Punnapra catering to the southern part. Fish marketing is in the hands of middlemen who lend money.

The mechanised sector is generally wary of the Alleppey fishermen who are well organised to capture any of the trawlers that appear on the horizon. Thottappally in the south is the only location where trawlers still anchhor.

QUILON

In the pre-motorisation era, Quilon district (Fig. IV-9) like Ernakulam was part of two different zones. North of Neendakara was the plank canoe zone and in the south was the small scale belt with dugouts and kattumaran s. Motorisation has broughht tremendous changes in technology.

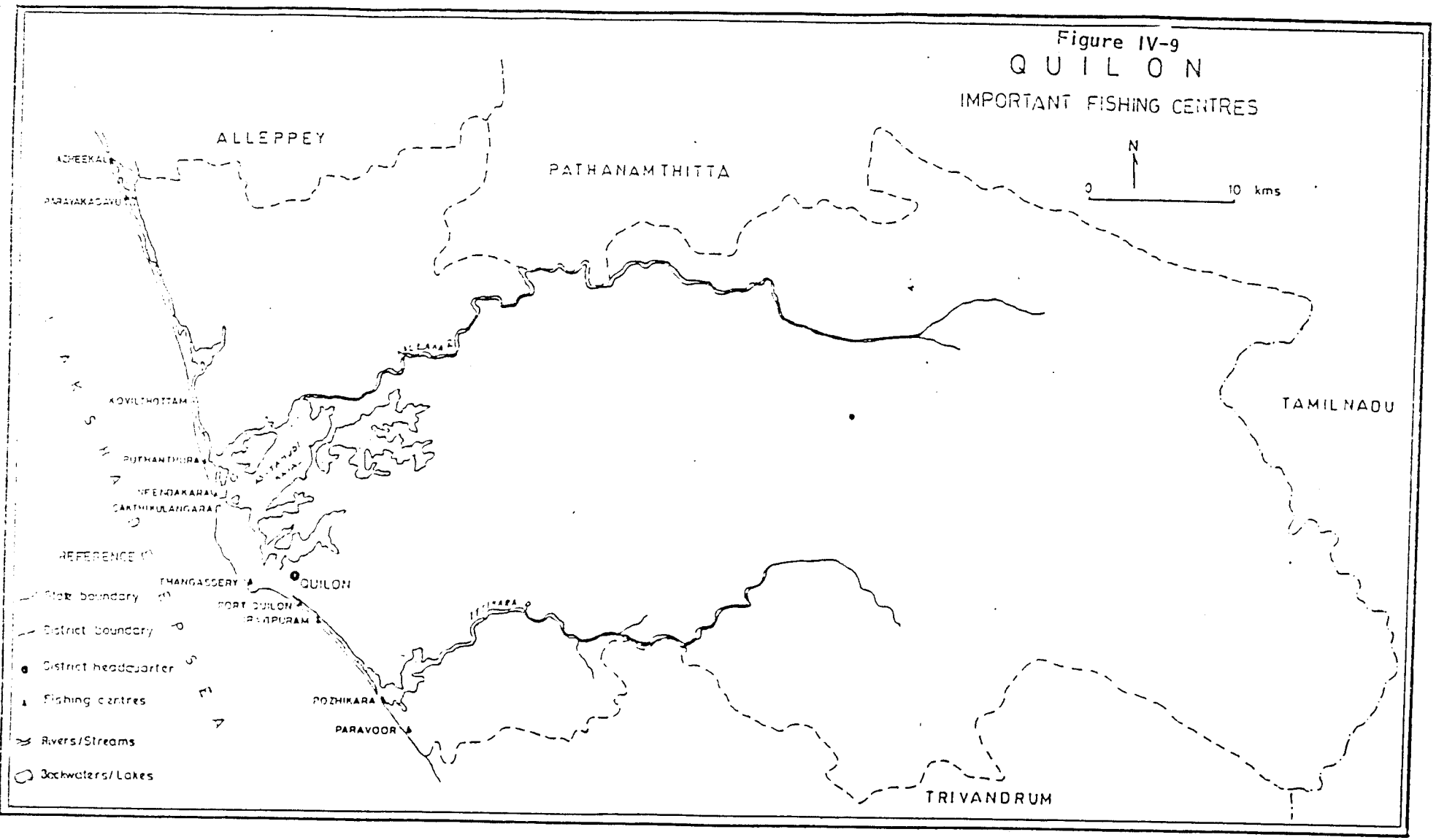


Figure IV-9
QUILON
IMPORTANT FISHING CENTRES
N
0
10 kms
ALLEPPEY
PATHANAMTHITTA
TAMILNADU
TRIVANDRUM
KOVILTHOTTAM
PUTHANTHURA
KARTHIKULANGARA
THANGASSERY
QUILON
PORT QUILON
PARAVOOR
REFERENCE
State boundary
District boundary
District headquarter
Fishing centres
Rivers/Streams
Backwaters/Lakes

Sea erosion being a severe problem, sea walls have been put up throughout the coast. While the small dinghies can be beached, there is no way that the thanguvallom can be beached. As a result, the fishermen anchor their craft in the canal behind their village and reach the sea navigating through the canal and Ashhtamudi lake till the bar-mouth at Neendakara.

The fisheries hharbour at Neendakara must during thhe monsoon months attract upto 3000 trawlers. It is also one of the largest wholesale markets for fish.

South of Neendakara, the Quilon town fishery from Thangassery to Pallithottam is the most important with about 400 motorised plywood boats and 2,000 fishermen operating from the densely populated town area. Medium dugouts which were the main craft in this area have been more or less substituted by the plywood boats.

The fishermen in the thanguvallom belt are Hindus, with Karithura being an exception. The colony of migrant fishermen at Neendakara are Christians. So are the fishermen further south upto Eravipuram further south, the fishermen are Muslim.

The mechanised sector has a major impact on the district. Quite a lot of artisanal fishermen from the thanguvallom belt as well as the Quilon town area participate as crew in the mechanised sector. Some of the villages like Kovilthottam have fishermen working exclusively in the mechanised sector.

TRIVANDRUM

The catamaran has always been the symbol of Trivandrum fisheries. Numerically it is still the dominant craft and possibly a majority of fishermen still work on the catamaran. But with the exception of a few villages like Marianad, Valiathura and Puthiyathura, the catamaran is used only for nearshore operations while the motorised phywood and plank boats are used for all types of operations round the year.

The northern part of Trivandrum (Fig. IV-10) from Edava to Arivalam is essentially a continuation of the three-log belt that starts in Quilon. From Mampally to Kollengode operates the four-log catamaran which is the same craft used by the Kanyakumari fishermen. In fact, Kanyakumari has always played a major role in influencing the technology of the Trivandrum fishermen.

A unique feature of Trivandrum fishery is the great variation in skills and gear preferences both between villages and individuals. Thhe fishermen of vizhinjam south (who are Christians) are quite dynamic, using a variety of gears and often operate beyond 100 m depth. In contrast, the fishermen of Vizhhinjam north (who are Muslim) depend exclusively on shallow water operations with the shore seine or boat seine. In general the catamaran fishermen use a variety of small gillnets (anchovy, sardine, mackeral, prawn etc. and this is common to all villages). The shore seines are basically pulled by older fishermen or those who treat the income as a bonus rather than as a regular wage.

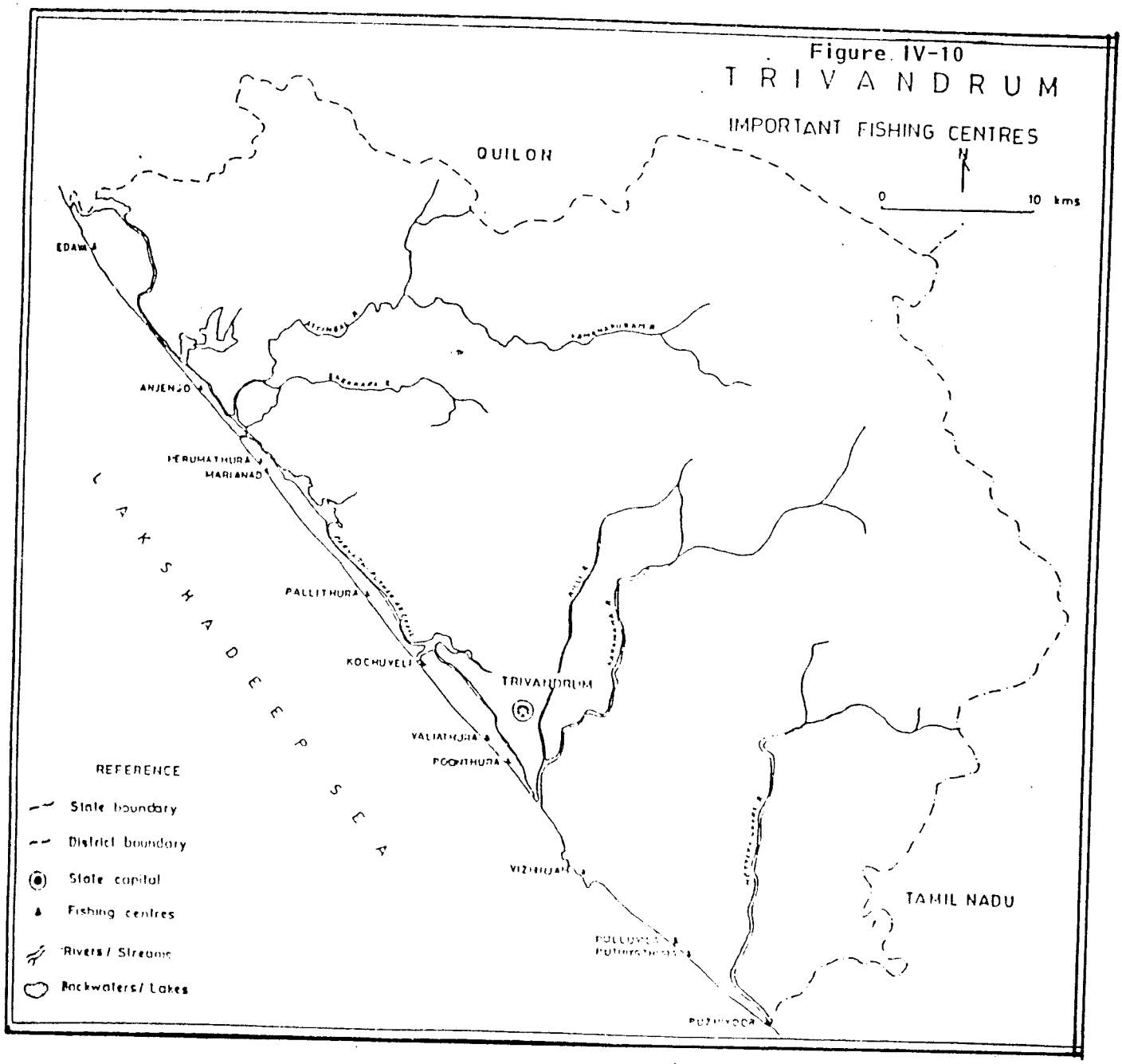


Figure. IV-10
TRIVANDRUM
IMPORTANT FISHING CENTRES
N
0
10 kms
QUILON
EDAVA
ANJENGO
PERUMATHURA
MARIANAD
PALLITHURA
KOCHUVELI
TRIVANDRUM
VALIATHURA
POONTHURA
VIZHINJAM
PUZHAVOOR
TAMIL NADU
ARABIAN SEA
REFERENCE
State boundary
District boundary
State capital
Fishing centres
Rivers / Streams
Backwaters / Lakes

Trivandrum remains the least motorised district in the state, with the predominance of the catamaran. Further, motorisation is uneven with large concentrations of motors at Vizhinjam, Pozhiyooor, Anjengo and Poonthura. Vizhinjam is more or less totally motorised. Valiathura, on e of the maior centres, still remains largely non-motorised.

Fisherwomen belonging to the Christian community play a major role in fish marketing, handling at least 75% of the total landings. Fish landing takes place in a dispersed manner in all villages. During monsoon months, most of the motorised units operate from Vizhinjam and hence there is greater concentration of landings at Vizhinjam in those months.

Mechanised fishing boats have no base in the district though during prawn and cuttlefish seasons trawlers from Colachel and Neendakara operate in the Trivandrum fishing grounds, competing with the artisanal sector. The fishing harbour at Vizhinjam is currently being used by the artisanal sector only. Nearly a thousand motorised plywood boats and plank-transom canoes anchor here during Jun-Aug. Once the harbour project is completed, deep sea vessels are expected to be berthed here.

SOCIAL STATUS

The fishing communities living along the Kerala Coast are belonging to three main religions. Christians fishermen are more in the south where as Muslim fishermen are more in the north Kerala. Almost all of them are recognised under backward community by the State Government. Many fishermen could not earn sufficiently even

to meet the day to day basic needs of their families (Sathiadhas and Venkataraman, 1983; Panicker 1980; Panicker and Alagaraja, 1981) The fishermen living below poverty line are mostly in the vicious circle of perpetual indebtedness. Private money lenders are the major source of credit (75%) followed by banks 12%, relatives (7%) and Co-operative societies (6%).

About 50% of the marine fishermen families live in huts. Basic sanitary requirements are very much limited in fishing villages and the fishermen mostly use the open sea-shore for their toilet purpose. About 50 percent of fishermen household have protected water supply and the remaining depend on well water. The average size of the fishermen family is 6.4 ranging from 5 in Trivandrum to 8.5 in Malappuram. Literacy rate among fishermen population is 23 percent. Out of them 81 percent completed primary standard, 16 percent secondary standard and 3 percent beyond secondary standard (Anon., 1981).

CHAPTER V

PRODUCTION TREND, RESOURCES AND ACOUSTIC SURVEY

To study the trends in production, data collected by the Central Marine Fisheries Research Institute, a nodal Institute for marine fishery research in the country, through its well tested and universally acclaimed stratified multi-stage random sampling design (Anon., 1983) have been considered.

During the 43 years period viz., 1950-92, the annual marine fish landings in the State varied from 1,05,457 tonnes in 1955 to 6,62,890 tonnes in 1990 (Table V-1). On an average 1,95,426t per year landed during 1950-60. It was 3,06,228 t during 1961-70 registering a 57 percent increases. During 1971-80, 1981-87 and 1988-92, it was 3,68,980., 3,41,584 and 5,80,825 t respectively. The above periods registered an increases of 20% , 7% and 70% respectively of the previous periods. On the whole there was steady increase in the marine fish landings in Kerala. The annual marine fish landings in Kerala have shown heavy fluctuation over the years (Table V-1).There is a tendency of upward swing after getting a lesser landings during the previous year. The only exemption is during the period 1988-90. This may be due to large scale introduction of outboard ring seine and heavy landings of pelagic fishes during this period. After large scale introduction of ring seine, the annual marine fish landings always crossed 4.70 lakh t.

TABLE V - 1

MARINE FISH LANDING ALONG KERALA COAST (IN TONNES)

YEAR	TOTAL	YEAR	TOTAL
1950	202047	1971	445347
1951	191032	1972	295618
1952	129345	1973	448269
1953	111999	1974	420257
1954	117034	1975	420836
1955	105457	1976	331047
1956	152213	1977	345037
1957	309926	1978	373339
1958	294655	1979	330509
1959	191375	1980	279543
1960	344605	1981	274395
1961	267494	1982	325795
1962	191421	1983	385817
1963	202380	1984	393472
1964	317974	1985	325536
1965	339173	1986	382791
1966	346744	1987	303286
1967	364129	1988	468808
1968	3455301	1989	647526
1969	294787	1990	662890
1970	392880	1991	564161
		1992	560742

(Source: Alagaraja *et al.*, 1994)

RESOURCES

Broadly classifying the resources as pelagic and demersal, it may be observed that the landing of pelagic groups varied from 153,013 t in 1987 to 439,937 t in 1989 almost coinciding with the minimum and maximum of marine fish landings of the period 1983-92 (Table V-2 & Fig. V-1)

TABLE V - 2

MARINE FISH LANDING ALONG KERALA COAST (IN TONNES)

Year	Demersal	Pelagic	Total
1983	111894	273923	385817
1984	139518	253954	393472
1985	120212	205324	325536
1986	164348	218443	382791
1987	150273	153013	303286
1988	203275	265533	468808
1989	207589	439937	647526
1990	229478	433412	662890
1991	207436	356725	564161
1992	240519	320223	560742

PELAGIC

Among the pelagic resources the dominant groups are the oilsardine, mackerel, other sardines, whitebaits, seerfishes, tunnies, carangids and ribbonfishes (Table V-3 & Fig. V-2).

Fig V-1

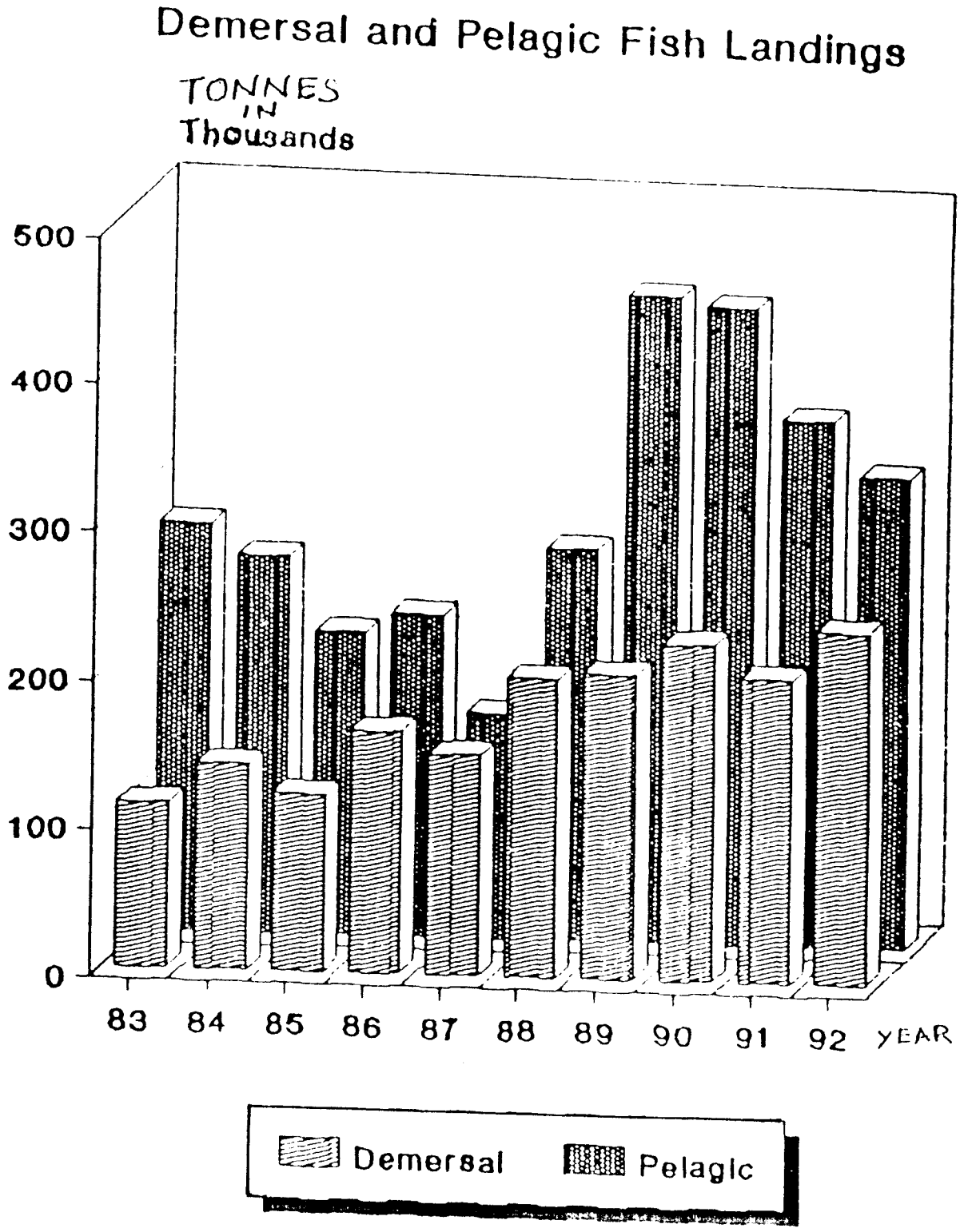

Demersal and Pelagic Fish Landings
TONNES
IN
Thousands
500
400
300
200
100
0
83
84
85
86
87
88
89
90
91
92
YEAR
Demersal
Pelagic

Fig V-2

Major Groups of Pelagic Fish Landings

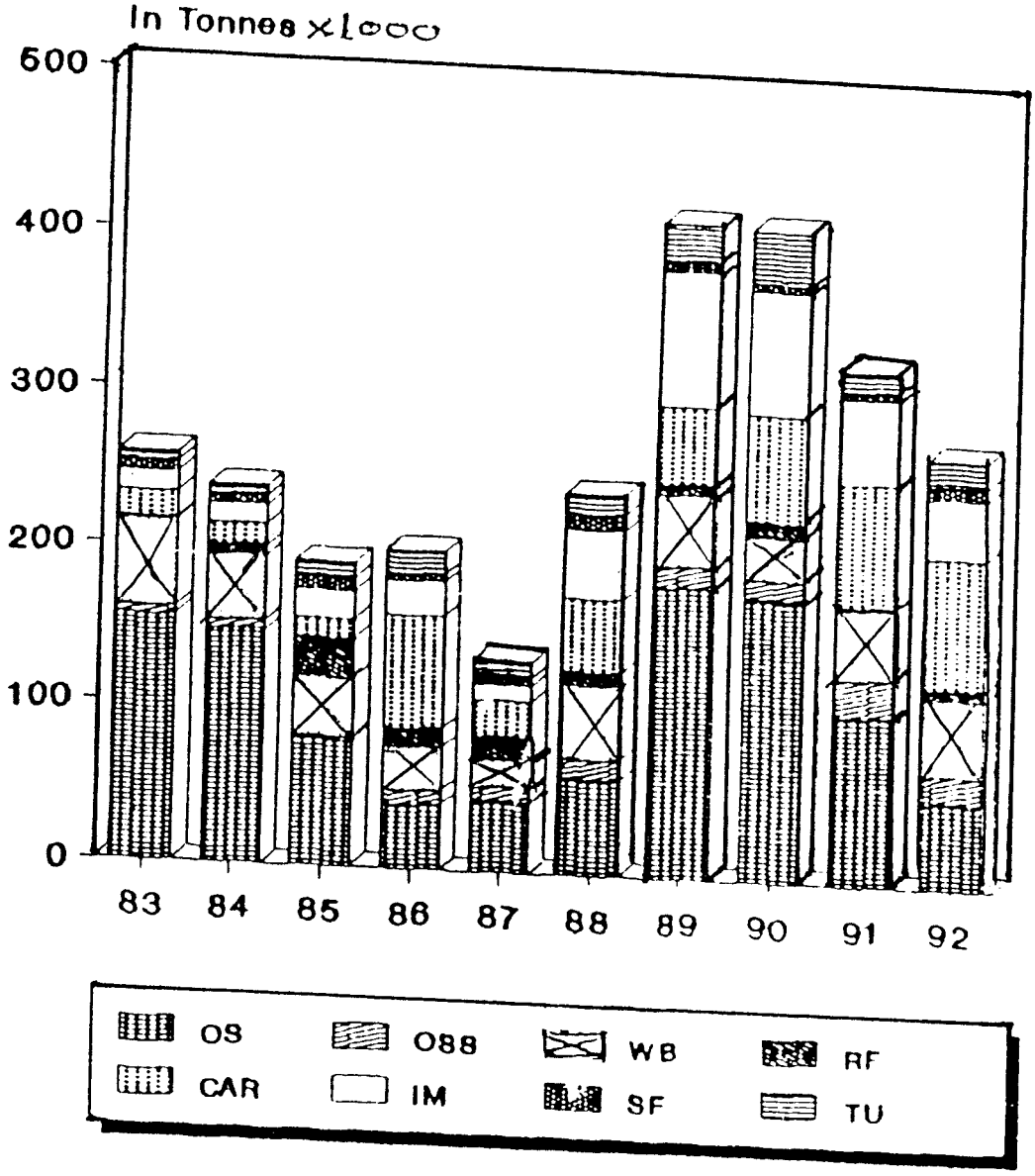


TABLE V-3

LANDINGS OF MAJOR PELAGIC RESOURCES ALONG KERALA COAST
(In Tonnes)

Year	Name of Fishes							
	Oil-sardine	Other Sardines	White-baits	Ribbon-fishes	Carangids	Mackerel	Seer-Fishes	Tunnies
1983	154879	5315	55042	1112	16528	12683	6999	5750
1984	147139	6022	41505	6464	13672	11746	6174	6168
1985	79225	2473	36227	25142	12839	18101	8458	9850
1986	40613	8934	27158	11880	71584	21876	4857	14786
1987	44717	8697	16599	15295	22771	10063	5181	10611
1988	60508	12701	45994	8952	47069	43938	10162	12913
1989	184879	13752	45127	7179	50219	85272	8029	22288
1990	179276	12900	26859	9751	69068	78335	5372	32615
1991	106263	23730	45273	2167	78726	53980	4600	13111
1992	54118	16967	48217	6162	85122	37909	8734	16219

DEMERSAL RESOURCES

Demersal groups of fishes, prawns and cephalopods contributed higher production during the decade. This is mainly due to large introduction of motorised craft and trawlers with the extended area of operation using modified craft and gears.

Among the demersal resources the dominant ones are catfishes, perches, croakers, lizard-fishes, elasmobranchs, flatfishes, big-jawed jumper, silverbellies, goatfishes, penaeid prawns and cephalopods. (Table V-4 & Fig. V-3).

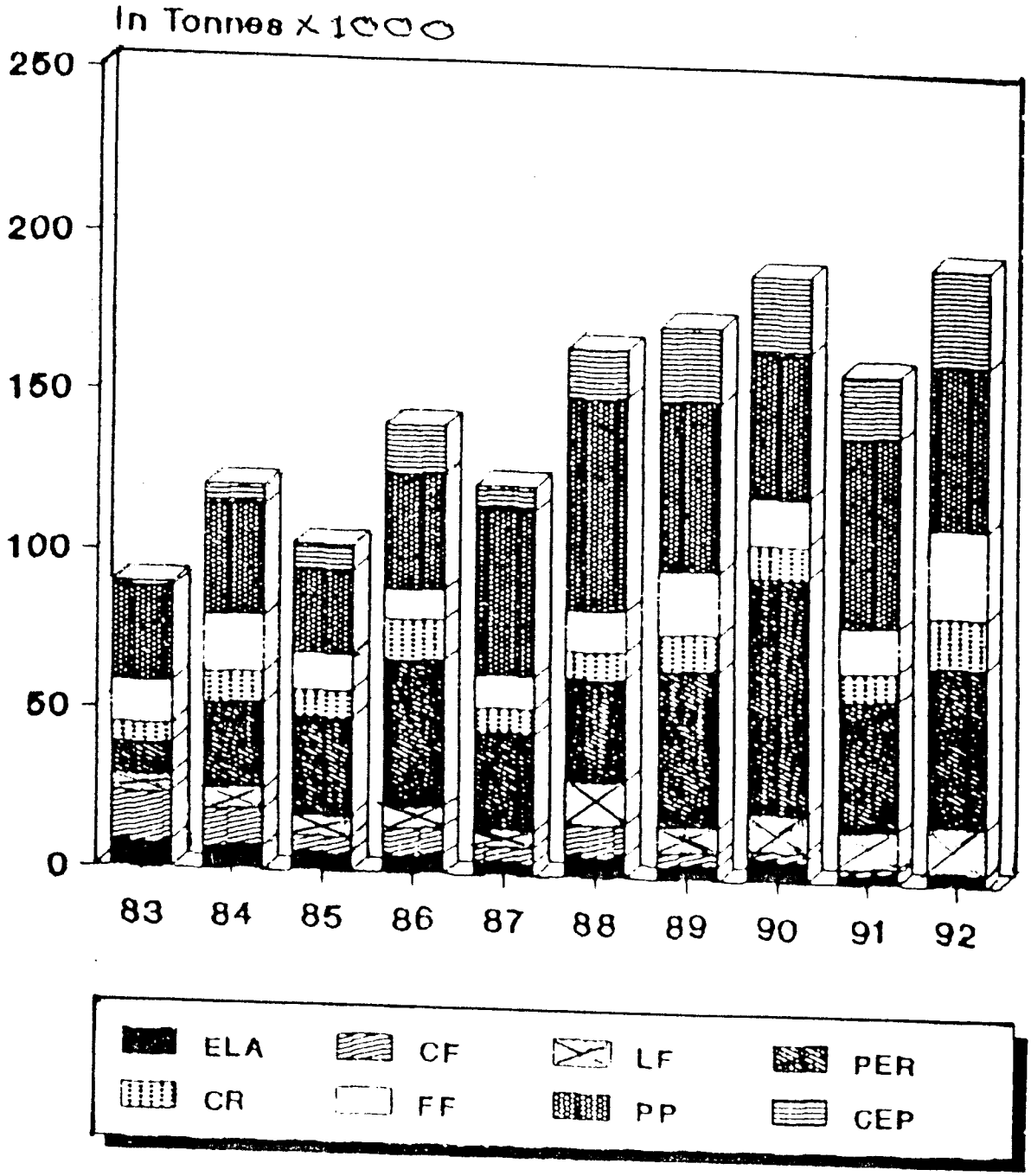
TABLE V-4

IMPORTANT DEMERSAL RESOURCES ALONG KERALA COAST (IN TONNES)

Year	Name of Species										
	Elasmo -brachs	Catfishes	Lizard-fishes	Perches	Croakers	Silver Bellies	Big-jawed jumper	Flat fishes	Pena-eid prawns	Cepha lopods	Goat fishes
1983	8537	15332	5426	9916	6111	9504	1099	13118	29754	1730	152
1984	7637	11582	2677	26882	9686	3911	1645	17745	35529	6022	75
1985	5972	5170	6300	30649	8624	3417	1041	11309	26684	8283	100
1986	6034	8594	6351	46004	12768	6007	1438	9392	37188	14987	213
1987	4473	4660	5212	30133	8161	6027	618	9917	52866	7535	684
1988	6761	9960	13415	32304	8470	6493	821	12723	67494	15155	9836
1989	4680	4097	7940	48986	11402	5354	1320	20061	53317	23488	6017
1990	6968	2739	11469	67356	10868	6195	2340	14505	45483	24206	6919
1991	3441	1744	11398	41112	8816	5643	623	13885	60318	19468	18824
1992	3323	1029	14126	50159	15603	4480	675	28445	51067	30625	7583

Fig V-3

Major Groups of Demersal Fish Landings



THE CHANGING SCENARIO

The fluctuations in the landings of marine fishery resources depend on two group of factors viz., fishery independent factors and fishery dependent factors such as nature, size and shape of the gear, its mesh size and the number of gears employed. Mechanisation of craft and gear was started in the early fifties in the state under indo-Norwegian Project in Quilon area. During the sixties cotton webbing gave place to nylon webbing. Purseseining for the first time in the State was introduced in the late seventies. Motorisation of the country craft was started in the eighties. Besides these, there are significant changes in the gear used by artisanal sector. Boat seine has been converted into mini purse-seine and country craft are converted into mini trawlers.

During 1983-92, there were heavy fluctuations in the total marine fish landings in Kerala ranging from 303,286 tonnes in 1987 to 662,890 tonnes in 1990. Gearwise marine fish landing during 1983-92 is given in Table V-5.

GEARWISE MARINE FISH LANDINGS ALONG KERALA COAST (IN TONNES)

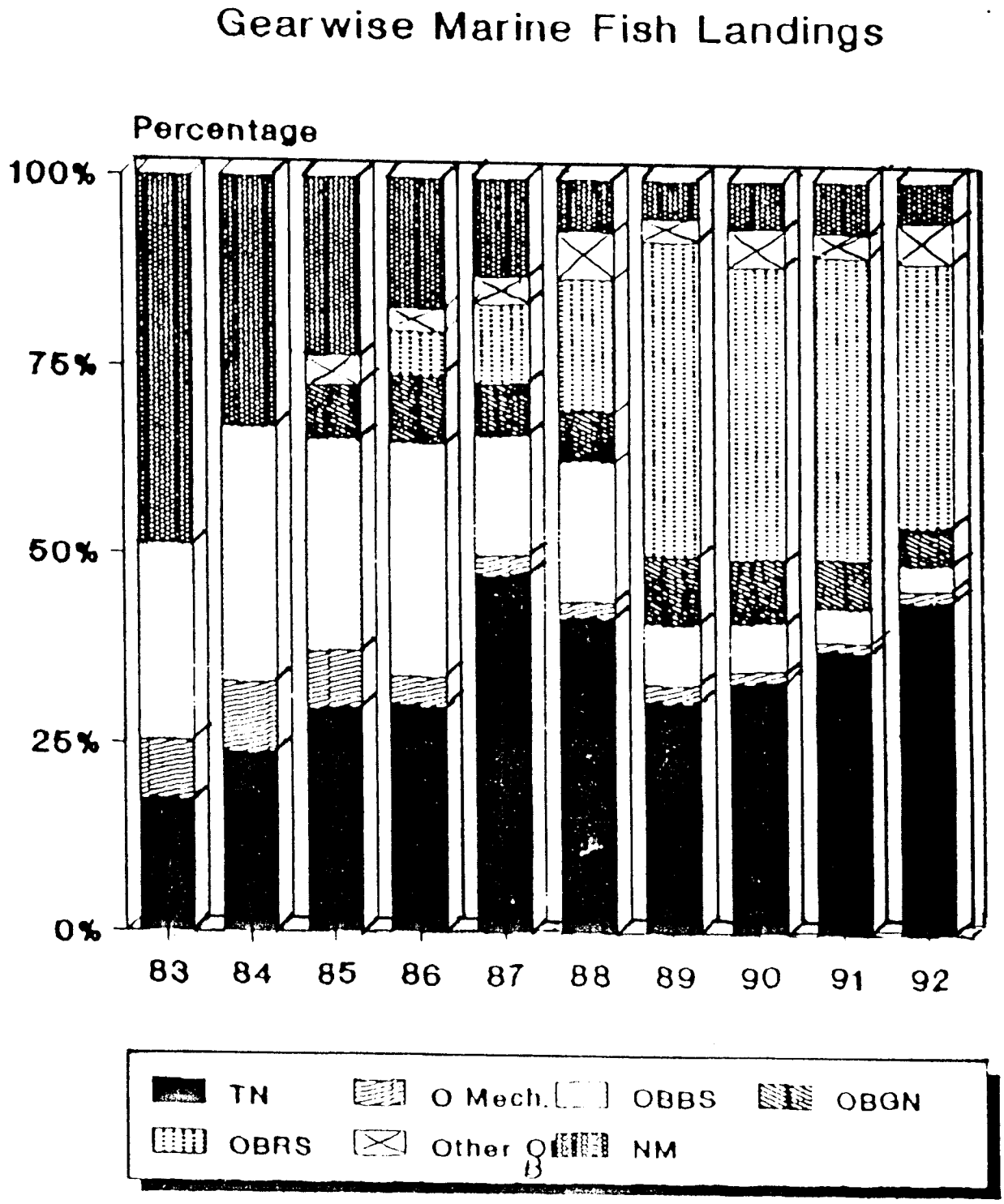
Year	TN	Other Mech.	OBBS	OBGN	OBRS	Other OB	TOTAL OB	NM	Grand Total
1983	67908 (17.63)	30162 (7.83)	99082 (25.72)	-	-	-	99082 (25.72)	188128 (48.82)	385280
1984	93835 (23.88)	35806 (9.11)	133313 (33.93)	-	-	-	133313 (33.93)	1299939 (33.08)	392893
1985	97037 (29.81)	23905 (7.34)	92002 (28.26)	23345 (7.17)	-	12122 (3.72)	127469 (39.15)	77125 (23.70)	325536
1986	115507 (30.17)	14278 (3.73)	118433 (30.94)	34263 (8.95)	22498 (5.88)	110 (2.90)	186282 (48.67)	66724 (17.43)	382791
1987	143913 (47.45)	7723 (2.54)	48416 (15.96)	21074 (6.94)	3155 (10.40)	10678 (3.52)	111726 (36.83)	39924 (13.16)	303286
1988	196020 (41.81)	9896 (2.11)	87800 (18.73)	31166 (6.65)	81886 (17.47)	29548 (6.30)	230400 (40.14)	32492 (6.93)	468808
1989	199217 (30.76)	14512 (2.24)	51477 (7.94)	58397 (9.01)	270903 (41.83)	19454 (3.00)	400231 (61.80)	33566 (5.18)	647526
1990	221955 (33.48)	9617 (1.45)	42162 (6.63)	55541 (8.38)	257853 (38.90)	33068 (4.99)	388624 (58.63)	42694 (6.44)	662890
1991	212736 (37.71)	6945 (1.23)	24973 (4.43)	36558 (6.48)	226330 (40.12)	17335 (3.07)	305196 (54.10)	39284 (6.96)	564161
1992	248356 (44.29)	8482 (1.51)	18898 (3.37)	28095 (5.01)	196416 (35.03)	30396 (5.42)	273805 (48.83)	30099 (5.37)	560742

Note : Figures in the brackets are percentages to total catch.
TN - Trawl net, OBBS - Out Board Boat Seine, OBGN - Our Board Ring seine, OB - Out Board
NM - Non mechanised, Mech - Mechanised

Prior to 1983, more than 50 percent of the marine fish landed in Kerala was by non-motorised traditional craft. After motorisation the contribution from non-motorised country craft which was 65% in 1981, started decreasing their contribution to 5.37% in 1992. Contribution from mechanised trawlers varied from 17.63% in 1983 to 47% in 1987. Contribution from other mechanised gears which was 7.83% in 1983 decreased to 1.23 % in 1991. On the other hand contribution from the motorised country craft started increasing from 25.72% in 1983 to 61% in 1989. Though out Board Ring seine was introduced in 1986, then its contribution was only 5.88%, it's contribution went upto 41% in 1989 (Table V-5 & Fig. V-4). Most of Boat seine (Thangu vala) were replaced by ring seine (Out Board) whhich is reflected in the catches of Out Board seien units which reduced to 3.37% in 1992 frm 25.72% in 1983.

Landings from non-motorised sector varied from 30,099t in 1988 to 188,128 t in 1983. After the imposition of partial ban of trawling during the monsoon period in 1988, 1989, 1990 and 1991 there is an increasing trend in the landings by these sector as in the case of total landings also. Other major gears in operation in the state and their roles are discussed below.

Fig V-4


Gearwise Marine Fish Landings
Percentage
100%
75%
50%
25%
0%
83
84
85
86
87
88
89
90
91
92
TN
O Mech.
OBBS
OBGN
OBRS
Other O
NM

TRAWLERS

After independence, mechanisation of fishing craft was initiated in the First Five Year Plan. By the end of First Five Year Plan about 650 boats were mechanised, most of them in the State of Maharastra. Due to incentives offered in the shape of technical and financial assistance new designs of mechanised boats have been developed in Kerala.

Under the Indo-Norwegian Project (INP) in the fifties engines and boats were given to fishermen at subsidised rate. During the early sixties there were about 150 mechanised boats in Kerala.

When the pressure for mass production of shrimp trawling and other fishing boats increased, some of the indigenously adopted designs of trawlers started emerging. The vessels operated along the Kerala Coast do not conform to any of the type of vessels introduced initially, but are a combination of all good features of more than one type. During the Third Five Year Plan period 30' and 32' (8 to 10 m) vessels formed the base for mechanisation. In the mid sixties a standardisation programme was initiated to increase the efficiency of trawlers. As a result of this the design of 30 and 32 footer trawlers were accepted as standard ones. At present the pressing need for larger vessels have rendered these boats obsolete and demand for larger vessels is increasing. Of late, the types of mechanised vessels in operation in Kerala are thirty footer, half decked boat for trawling and gillnetting, thirty footer fully decked boat for trawling, thirty two footer and thirty six footer for shrimp trawling. The 32 and 34 footer vessels form the base of the shrimp trawling fleet of Kerala.

Midwater trawling is used to capture pelagic and column living fishes that school at various levels of sea. The midwater trawl net resembles more of a cone of netting rather than the flat bag of the bottom trawl. Generally, in Kerala for shrimp trawling two seam trawls are used while four seam trawls are used for fish trawling. For operation in deeper waters especially for cuttle fish larger trawls are used. Large bottom trawls are of two seam construction. Shrimp trawls are usually not provided with an overhang (Nair, 1969).

During the periods 1980-92, trawl landings in Kerala varied from 67,900 t in 1983 to 248,356 t in 1992. During this period percentage contribution of trawl net to the total landings varied from 18% in 1983 to 47.4% in 1987 (Table V-5). Trawling effort in terms of unit operation varied from 268,000 in 1981 to 863,000 in 1988. There was an almost increasing trend of trawl effort in Kerala during 1981-88 and decreasing trend from 1989 onwards (Table V-6).

Annual CPUE varied from 172 kg in 1983 to 458 kg in 1992. There is an increasing trend in CPUE as well as total catch during the period 1988-92. This may be due to the increased size of the trawlers and extension of fishing ground. The partial ban of trawling during the monsoon period might have influenced this trend. Quarterwise, catch, effort and CPUE of trawl net is given in Table V-7.

TABLE V-6

CATCH, EFFORT AND CPUE OF DIFFERENT GEARS IN KERALA

Gear	Year												
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Trawl													
Catch	106061	49313	62321	67008	93835	97037	115507	143913	196020	199217	221955	212736	248356
Effort	310000	268000	300000	393000	319000	370000	402000	586000	863000	595000	532000	553000	542000
CPUE	342	184	207	172	294	262	287	245	227	334	417	384	458
Purse Seine													
Catch	16479	17673	11496	14274	20799	11482	4648	904	760	8796	4649	4107	6196
Effort	5000	9000	9000	7000	7000	5000	2500	1100	570	3700	2000	3000	3000
CPUE	3296	1963	1277	2039	2971	2296	1859	822	1333	2932	2324	1369	2965
Mechanised Gillnet													
Catch	9809	6021	11322	15780	14707	12361	9384	5341	8563	5131	4041	1844	1776
Effort	68000	58000	80000	87000	88000	84000	70000	45000	71000	33000	29000	14000	11000
CPUE	144	120	141	181	167	147	134	118	120	155	139	131	161

NOTE: Catch in Tonnes, Efforts in Units Operation, CPUE in Kg.

TABLE V - 7

QUARTERWISE CATCH, EFFORT AND CPUE OF TRAWLERS IN KERALA

	I Quarter (Jan - Mar.)			II Quarter (Apr. - Jun.)			III Quarter (July - Sep.)			IV Quarter (Oct. - Dec.)		
Year	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	22247	111200	200	23820	94400	252	31693	51900	610	19277	112500	171
1986	22558	145700	155	25956	108600	239	42186	46800	901	24807	101300	245
1987	31658	163200	194	42194	170900	247	37201	62300	597	32860	189900	173
1988	42990	221800	194	50952	211500	241	52362	87000	602	49716	342800	145
1989	46347	210200	220	48345	172600	280	46298	71300	649	58227	141000	413
1990	53321	204169	261	61977	138552	447	54828	179270	306	51829	140089	370
1991	49035	179624	273	43367	145823	297	65309	81463	802	55025	146728	375
1992	61701	193000	319	42543	114000	373	64137	81000	792	79975	154000	519

Note: Catch in tonnes, efforts in units operation, CPUE in kg.

It can be seen that during the period 1985-92, maximum CPUE observed during third quarter in almost all the years. After the imposition of partial ban, catch and CPUE has increased in all the years. Though the effort was minimum during the third quarter of each year, catch and CPUE was more during the third quarter. This may be due to the effect of partial ban of monsoon trawling in Kerala. Percentage contribution of trawl in the landing of major group of fishes during 1984-92 is given in table V-8.

Lizardfishes, perches, goatfishes, crackers, silverbellies, big jawed jumper, flatfishes, ribbonfishes, Penaeidprawns and cepholopods were the major groups landed by trawl. More than 95% of the landings of the Lizardfishes were contributed by trawls. In 1991, 99% of the Lizardfish was landed by this gear alone. This fish was available in trawl during second, third and fourth quarters and its contribution was more than 5% of the trawl landings during the above quarters Table V-8). Contribution of trawls in the perch landings varied from 80.5% in 1984 to 89.3% in '92. Among the perches threadfin breams dominated the catches. This fish was available in trawl catches almost throughout the year, maximum landings was in third quarters. Goatfishes were observed in the landings of trawl net from 1985 onwards and its share was only 2% then. Subsequently trawl net became the major gear for this fish. Trawls contribution varied from 79.8% in 1986 to 99.5% in 1990 and '91. Goatfish was absent in the second quarters throughout this period and maximum contribution of 15% of trawl landings was noticed during third quarter of 1991. More than 50% of the croackers landed were from trawlers except in 86. In that year it was only 26.4%.

TABLE V-8

PERCENTAGE CONTRIBUTION OF TRAWL IN THE LANDINGS OF MAJOR GROUPS OF FISHES IN KERALA

Groups	Year								
	1984	1985	1986	1987	1988	1989	1990	1991	1992
Elasmobranchs	9.4	10.0	18.3	22.3	35.2	38.8	22.8	33.6	41.7
Catfishes	28.2	20.8	7.9	34.0	40.6	15.4	7.0	53.2	33.5
OilSardine	0.1	0.2	-	-	0.1	0.4	3.2	0.2	0.2
Other Sardine	0.1	-	0.5	0.4	2.4	1.0	1.4	0.8	1.7
Whitebaits	2.6	3.2	7.9	23.44	13.4	20.0	14.9	24.0	18.1
Lizardfishes	96.5	98.0	98.2	97.3	97.6	94.2	98.4	99.0	98.5
Perches	80.5	83.8	86.7	85.7	87.6	88.0	88.2	87.0	89.3
Goatfishes	2.0	79.8	99.2	95.6	97.5	99.5	99.5	98.8	
Croackers	62.4	72.0	26.4	60.6	74.4	52.4	54.4	68.6	49.3
Ribbonfishes	3.4	2.1	23.2	22.2	95.3	84.7	8.6	75.2	79.0
Carangids	7.2	14.2	5.2	34.0	28.0	31.3	24.4	29.2	
Silverbellies	48.4	41.0	43.3	72.8	43.0	36.6	63.6	60.6	74.6
Big Jawed Jumper	16.5	61.4	52.5	66.0	74.0	26.8	10.5	25.2	29.9
Mackerel	0.1	0.2	1.0	3.8	6.3	3.0	4.4	4.6	10.7
Seerfishes	-	-	-	1.0	8.3	0.9	1.2	2.7	5.8
Tunnies	-	-	-	-	-	-	-	0.9	0.1
Flatfishes	58.7	84.1	44.2	76.5	66.5	76.7	82.5	82.0	53.1
Penacid Prawns	70.2	87.7	67.4	89.7	72.5	66.4	75.1	73.6	78.0
Cephalopods	61.4	59.5	44.0	92.5	92.3	90.5	77.2	90.0	89.9

The silver bellies landings fom trawlers varied from 36.6% in 89 to 74.6% in 92. Big jawed jumper landings from trawls varied from 10.5% in 90 to 74% in 88. Then it started declining. A minimum contribution of 44.2% in 86 and a maximum of 82.5% in 90 was observed in the case of flat fishes. During 84 to 92 penaeid prawns was the most dominant group in the trawl landings and hence a targeted group. Trawl contribution in the landings of this group varied from 66.4% in 89 to 89.7% in 87. This resource is available during all the quarters maximum during second quarter (followed by first (Table V-9). During the period of discussion, economic compulsions were the promoting factors for the trawlers in targeting cephalopods, its coontribution varied from 44.4% in 86 to 92.5% in 87. Trawlers landed cephalopods in all the quarters, maximum was in the fourth quarter. In some of the years especially in 1988, '89, '91 and '92 contribution of this gear was more than 75% in the landings of ribbonfishes. In other years the contribution varied from 2.1% in 85 to 79% in 92. Trawlers landed considerable quantity of stomatopods also. Maximum contribution was noticed during the first quarter followed by fourth. Stomatopods were absent in trawler catch during third quarter except in 1988. In the third quarter trawlers concentrate on 'Karikkadi' prawns and depth of operation also changes thereby avoiding stomatopods grounds.

TABLE V-9

QUARTERWISE PELAGIC AND DENERSAL LANDINGS IN TRAWL (IN TONNES)

Year	I Quarter			II Quarter			III Quarter			IV Quarter			G Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	1062	21185	22247	1229	22591	23820	366	31327	31693	2445	16832	19277	5102	91935
1986	1625	20933	22558	3461	22495	25956	135	42051	42186	5777	19030	24807	10988	104509
1987	3800	27858	31658	6691	35503	42194	1592	35609	37201	7147	25713	32860	19230	124683
1988	5428	37562	42990	14533	36419	50952	2615	49747	52362	15916	33800	49716	38492	157528
1989	6599	39748	46347	11491	36854	48345	5562	40736	46298	16520	41707	58227	40172	159045
1990	5790	47531	53321	16794	45183	61977	3844	50984	54828	17211	34618	51829	43639	178316
1991	5643	43392	49035	14252	29551	43803	8649	56060	64709	14574	40451	55025	43118	170054
1992	8359	53342	61701	14396	28147	42543	9530	54607	64137	27794	52181	79975	60079	188277

It can be seen that in all the years maximum landing of pelagic was in the fourth quarter and least in the third quarter. During third quarter trawlers target demersal fishes and prawns, especially threadfin-breams. lizard fishes and P. stylifera but during the fourth quarter, subsequent to the declining catches of demersals, there is a change in the target species as well as gear employed (fish trawl) thereby augmenting the catches of pelagic. During the third quarter demersal landings varied from about 31,000 t in 1985 to 56,000 t in 1991 and in fourth quarter maximum was 52,181 t and minimum of 16,832 t were landed in 1992 and 1985 respectively. During fourth quarter, using fish trawl, they used to land large quantity of quality fishes which fetch higher prices in the market. A perusal of the total landings by trawlers reveal that there was an overall increase in landings over the years in both the groups of pelagic and demersals. The overall increase in landings reflected in CPUE also. This increase in landings and CPUE can be attributed to the extended area of operation beyond 50m depth and enlargement of fishery vessels, long voyages etc.,

PURSE-SEINES

Commercial purse-seining started in the State by the end of 1979 with a small fleet of 20 purse-seiners. By 1980 the number rose to 70. Unlike in Karnataka, where the purse-seining is the main stay in fishery, in Kerala it did not pick up. The sudden introduction of large number of purse seines brought in a boost in the production of cat fish. The steady yield of cat fishes along Kerala showed a decreasing trend after the massive purse seines operations in Karnataka (James et al., 1989). At present there are only 40 purse seiners in Kerala (Anon.,

1990). In Kerala purse seiners are operated only in Ernakulam District. Purse-seining is mainly meant for harvesting pelagic group of fishes. It has also helped to some extent in augmenting the demersal fish production. Purse-seine CPUE varied from 822 kg in 1987 to 3296 kg in 1980 (Table V-6).

TABLE V-10
PERCENTAGE CONTRIBUTION OF PURSE-SEINE IN THE LANDING OF MAJOR GROUPS OF FISHES

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992
Elasmobranchs	0.40	-	-	-	-	-	-	0.20	-
Catfishes	2.80	-	3.00	-	0.40	2.00	-	0.50	6.70
OilSardine	10.10	6.90	0.80	0.20	0.10	2.20	1.80	1.80	3.90
Other Sardines	8.40	8.00	2.90	-	-	0.60	0.30	2.00	5.20
Whitebaits	0.10	-	-	-	-	-	-	0.40	-
Croakers	0.20	-	-	-	-	-	-	-	0.10
Carangide	5.50	0.20	0.40	0.60	0.70	1.30	-	0.10	0.20
Mackerel	23.10	27.90	4.80	3.90	0.50	3.80	1.30	2.20	4.00
Seerfishes	1.30	-	-	-	-	6.70	1.00	-	-
Tunnies	-	6.20	15.70	0.90	0.50	-	-	0.20	8.20
Penaeid Prawns	-	0.10	-	-	-	-	-	0.20	0.10

Oil sardine, mackerel, tunnies, carangids and other sardines were the major shoaling pelagic constituents of purse seine landings (Table V-10). To a lesser extent, landings of cat fishes, seer fishes and sporadic occurrences of penaeide prawns were also observed. Constribution of purse-seine in the landings of oilsardine varied from 0.1% in 88 to 10.1% in 84.

MECHANISED GILLNET

Mechanised gill net is a passive gear which is relatively more fuel efficient per unit of production. Gillnet can be operated in a variety of ways. To catch midwater fish, they can be operated as anchored floating nets and as from drifting nets to catch surface as well as midwater fishes. In some parts of Kerala, gillnet was used as encircling gillnets for mackerels. When ever the gear was operated as encircling gillnets, the foot rope touched the bottom when operated at lower depths. Operation as encircling gill net took place only when large shoals of fishes were sighted.

Mesh size is the most important aspect influencing the efficiency of this gear. By the use of the correct mesh size and high degree of uniformity in the size of all meshes, the gear becomes highly selective and this is an important factor in the management of fish population.

Elasmobranchs, catfishes, carangids, seerfishes, tunnies and mackerel were the major components in the landings of Mechanised Gillnet during 84 to 92. It was observed that percentage contribution of Mechanised Gillnet in the landings of elasmobranchs varied from 1.9% in 89 to 45.5% in 84. This group was available throughout the year, maximum was in the first followed by fourth. There was decreasing trend in the percentage contribution of elasmobranchs over the years. During the period 1986 to 92 there was a decreasing trend in the contribution of mechanised Gillnet (Table V-6) to the catfish landings.

Maximum contribution of 37.6% was observed in '85. Catfishes were mainly landed during the first, third and fourth quarters. Mechanised Gillnet contribution to the carangids landings varied from 0.1% in '91 to 3.5% in '85. Seerfish is yet another important group in Mechanised Gillnet landings in Kerala. A minimum of 5% in 92 to a maximum of 49.7% in 84 was observed in this gear. Seerfishes were landed throughout the year, maximum contribution came in the first and fourth quarters. In 84 Mechanised Gillnet contributed more than 31 percent of tunnies landings in Kerala while it was least in '91 (4.4%).

More than 50% of gillnet landings in the second quarter during 85-89 was tunnies and it was available throughout the year. Mackerel was also present in the Mechanised Gillnet landings. Contribution of this gear to mackeral landings ranged from 0.1% in 89 and 91 to 4% in 84.A decreasing trend was observed over the years.

DISTRIBUTION AND MARKETING

The consumer preference for the marine fish is always for fresh fish in internal markets. The distribution pattern of fish to the end users in the domestic market indicates that about 75% supplies are made in fresh form, 12 percent in iced and 13% as dried form (Sathiadhas and Panikkar, 1988). Exportable varieties like prawns, lobsters, crabs, cuttle fishes etc., are mostly supplied to processing plants for freezing, canning, etc.

All the fishing villages along Kerala Coast constitute the primary marketing centres of marine fish. The producers offer their marketable catch for sale, not by weight but by measures of heaps, lots or baskets; such unit measures vary not only from locality to

locality but also with in the same locality and for the same types of fish depending upon the size of the catch. The fish is generally auctioned by traditional auctioners or middlemen on commission basis. who also take the responsibilities for realising the sale proceeds from the traders. In Kerala mostly these auctioners are fisher women / fishermen. About 30 percent of the marine fish are marketed close to the landing centres by retailers who carry the fish either by heads, bicycles or auto rickshaw. The major part however is taken to the fish markets in the centres and towns run by the corporation or Municipalities or to the private fish markets. The rest of the stock is transported by vans, trucks and trains to distant markets.

EXPORT TRADE

Traditionally, Kerala is an exporter of marine products. Dried fish and dried prawns were the main items shipped in earlier times. In the last ten years frozen items have been increasingly exported. Cochin is the only port in Kerala handling the export cargo. shrimps, lobster tails, shark fins, fishmaws, beache-de-mer, seashells, edibile oyster, mussels, seaweeds and cuttlefish are the potential items of export. The quantity of marine products exported from the State increased from almost 9570 t fetching a value of Rs.46.62 lakhs in 1964 (Anon., 75) to 49094 t fetching 414.25 crores in 1993 (Anon., 93).

FISH PROCESSING INDUSTRIES

Many processing plants in the private as well as government sector have come up along with the increase of sea food exports in Kerala over the years. There are at present 50 ice plants and cold storage centres, 16 freezing plants, 10 canning factories in the State. The high demand for nylon and synthetic nets paved the way to set

up a number of net making plants both in private and public sector.

TRANSPORTATION

Almost all the fish landing centres of Kerala Coast are well connected with motorable road facilities. Mode of transportation of fish to different markets are by head loads, cycles, auto, vans, tempos, trucks insulated vans and trains. The processers and exporters are in general using only the road transportation system for moving marine products either for processing or for shipping.

SPOILAGE OF MARINE FISH

About 9% of exportable and 30% of non-exportable fish catch were spoiled at the tiime of landing itself. (Anon., 1984). With regard to the landings of country crafts 13% of the exportable variety and 29% of the non-exportable variety were getting spoiled. Bulk of the spoiled fish was getting converted either as dried fish or as fish meal. Quantum of fish spoiled also substantial. With the increase in distance the quantity of ice used has to be increased to minimise the spoilage. Plastic boxes are used to avoid the spoilage by stacking systematically.

ACOUSTIC SURVEY

Knowledge of fish stocks, the pattern of their distribution, migration, abundance and optimum levels of exploitation is essential for proper sustained fisheries development and management. Acoustic equipments are used for the collection of some of the required data to provide information on some of the aspects of fish stock.

Acoustics have made revolutionary impact in the field of fisheries. Acoustic instruments are used primarily in determining the depth of water in the sea, mapping the bottom profile of the ocean floor, detecting anything submerged underwater and estimation of fish resources qualitatively and quantitatively. Consequently, revolutionary changes have been brought about in acoustic instrumentation. Research vessels and fishing vessels fitted with different acoustic instruments scan sea areas to locate and estimate fish stock which is termed as "Acoustic Surrey". Acoustic instruments are also employed for detecting and evaluating the Deep Scattering Layers (DSL) composed of zooplankton and micronekton. The major acoustic instruments used in fisheries are the sonar for searching fish shoals, echo-sounder for detecting fish shoals and their depth, trawl-sonde for aimed trawling and echo-integrator for fish biomas estimation.

INTEGRATOR SURVEY

The out put of the echo- sounder is connected to the echo-integrator (Fig V-5) which sums the echo signals received. The sum of the echo signals received per nautical mile steamed is an index of the amount of fish recorded and therefore a measure of the density of fish in that area.speed and distance log provides an electrical signal for every nautical mile which is used to reset the echointegrator. The out put of the echointegrator per nautical mile is available at the data terminal in a print out form. The vessel fitted with above instruments sail as a

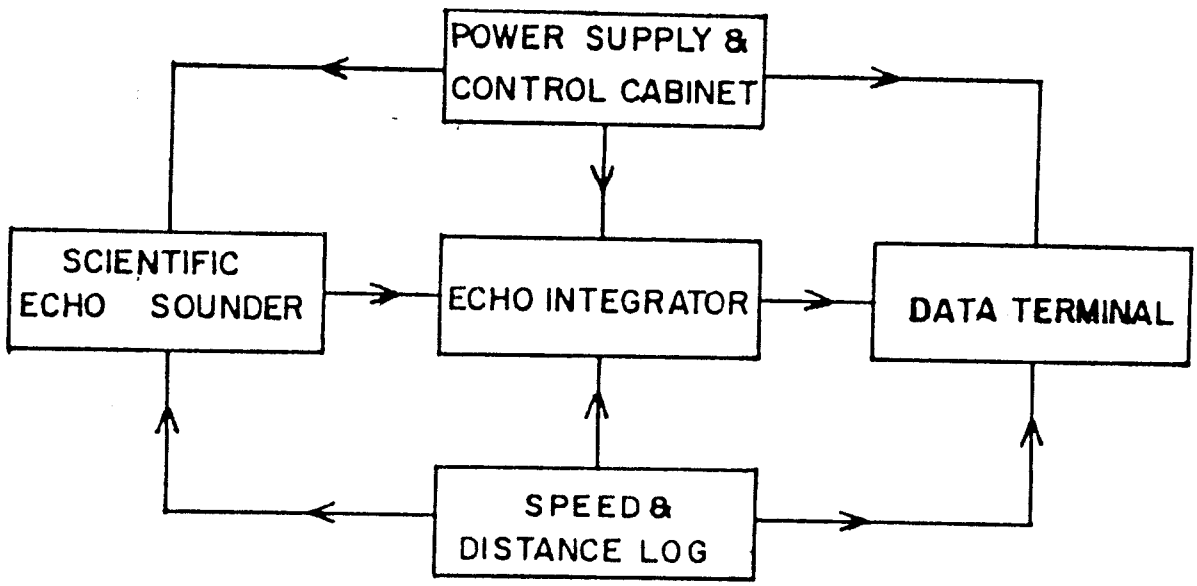


FIG. V-5 - BLOCK DIAGRAM OF ACOUSTIC SURVEY SYSTEM USING ECHO INTEGRATOR

pre determined track with the instruments switched on. The integrator deflection for every 1 nautical mile is noted. At the end of the cruise, the value obtained (the amount of deflection in mm per nautical mile) is plotted along the track of the vessel on the chart and zero density line is drawn. With the chelp of planimeter the area 'A' in nautical milesquare ($n.mi^2$) of fish concentration is obtained. After determining the average integrated deflection $\bar{m}$ (mm/n.mi) the average density, $\bar{d}$ ($t/n.mi^2$) is obtained as per the following equation.

The echo-integrator output signal is proportional to the average fish density within the volume sampled by an echo-sounder beam (Forbes and Nakken, 1972).

$$\bar{d} = c\ \bar{m}$$

where c is = Proportionality coefficient (the system constant) depending on the parameters of the acoustic system, environment and the acoustic deflection properties of fish (assuming that the fish in the area are of the same species or of species with same acoustic properties).

The value of the proportionality constant, c is estimated experimentally by measuring the echo-integrator output signal against the known quantity of fish as described below under the heading "live fish calibration of integrator".

Once the area A($n.mi^2$) and density $\bar{d}$ ($t/n.mi^2$) are known the biomas W (tonnes) is obtained from the relation $W = A\ \bar{d}$.

The above methodology was followed in the FAO/UNDP Pelagic Fisheries Project during 1971-'79 using scientific echo-sounder EK 38 and 120 and echo-integrator QM Mark-II onboard R.V. Rastrelliger (Vittulo et al., 1980). Subsequently from 1985 onwards the CMFRI adopted the same methodology in estimating fish biomas using scientific echo-sounder EK-400 and echo-integrator QD onboard FORV. Sagar Sampada (Natarajan, 1990)

SONAR SURVEY

Estimation of fish biomass using echosounder and echo-integrator is not possible upto 10 m below the surface of the water since the transducer of echo-sounder is situated on the hull of the vessel 5 m below the water surface. Due to the noneffectiveness of the Time Varied Gain (TVG) function of echo-sounder and scattering of fish, because of noise generated by the vessel engine and propeller, the estimate for another 5 m cannot be taken as realistic. Therefore, sonar is used to estimate fish biomass upto 10 m from the surface. This is achieved by titling the transducer to zero degree and fixing the face of the transducer either to the port or starboard at 90^{o} or 270^{o} with respect to the bow of the vessel. The number of shoals recorded in the sonogram per anutical mile is counted. The area of each shoal is obtained by measuring the length and breadth of the echosign and multiplying them. The height of the fish shoal is found out from the echosounder. The volume of each shoal is calculated by multiplying area with the height. The packing density of the shoal in terms of

kg per m^3 is obtained either by encircling the shoal with pursesine or by using under water camera. By multiplying the volume of fish shoal with packing density, the absolute biomass is arrived at in terms of tonne per square nautical mile after introducing appropriate conversion constant. Fish distribution chart is also drawn based on the observed concentration in the surveyed area.

Biomass estimates based on sonar surveys conducted by the UNDP/FAO/Pelagic Fisheries Project during 1971-'79, for the combined stock of mackeral and oilsardine along the west coast from 08^{o} to 17^{o} N upto 14 m depth from the surface during the year 1975, 1976 and 1978 was 700, 600 and 147 thousand tonnes respectively (Krishnarao et al., 1990). (Table V - 11)

LIVE FISH CALIBRATION OF INTEGRATOR

Live fish calibration of echointegrator is carried out as per Johnannesson and Losse (1975) to estimate the acoustic system constant C which is required for biomass estimation. A known concentration of life fish is impounded in a special cage and placed underneath the vessel within the centre of othe acoustic beam (Figure V-6). The integrator output is measured for 6 minutes considering the speed of the vessel is 10 knots per hour.

TABLE V - 11 **Distribution of total fish biomass in thousands of tons per 1° of latitude, between 20 and 120 m isobaths**

Latitude	Demersal	Pelagic	Demersal + Pelagic
16° - 17° N	90	77	167
16° - 16° N	236	21	257
14° - 15° N	119	144	263
13° - 14° N	179	195	374
12° - 13° N	132	91	223
11° - 12° N	465	371	836
10° - 11° N	66	326	392
9° - 10° N	56	194	250
8° - 9° N	53 (34)	209 (46)	262 (80)
7° - 8° N	30 (39)	58 (68)	88 (107)
TOTAL	1,426 (73)	1,886 (114)	3,112 (187)
GRAND TOTAL	1,499	1,800	3,299

( ) East of 77° 30' longitude Source: (Krishna Rao et al., 1980)

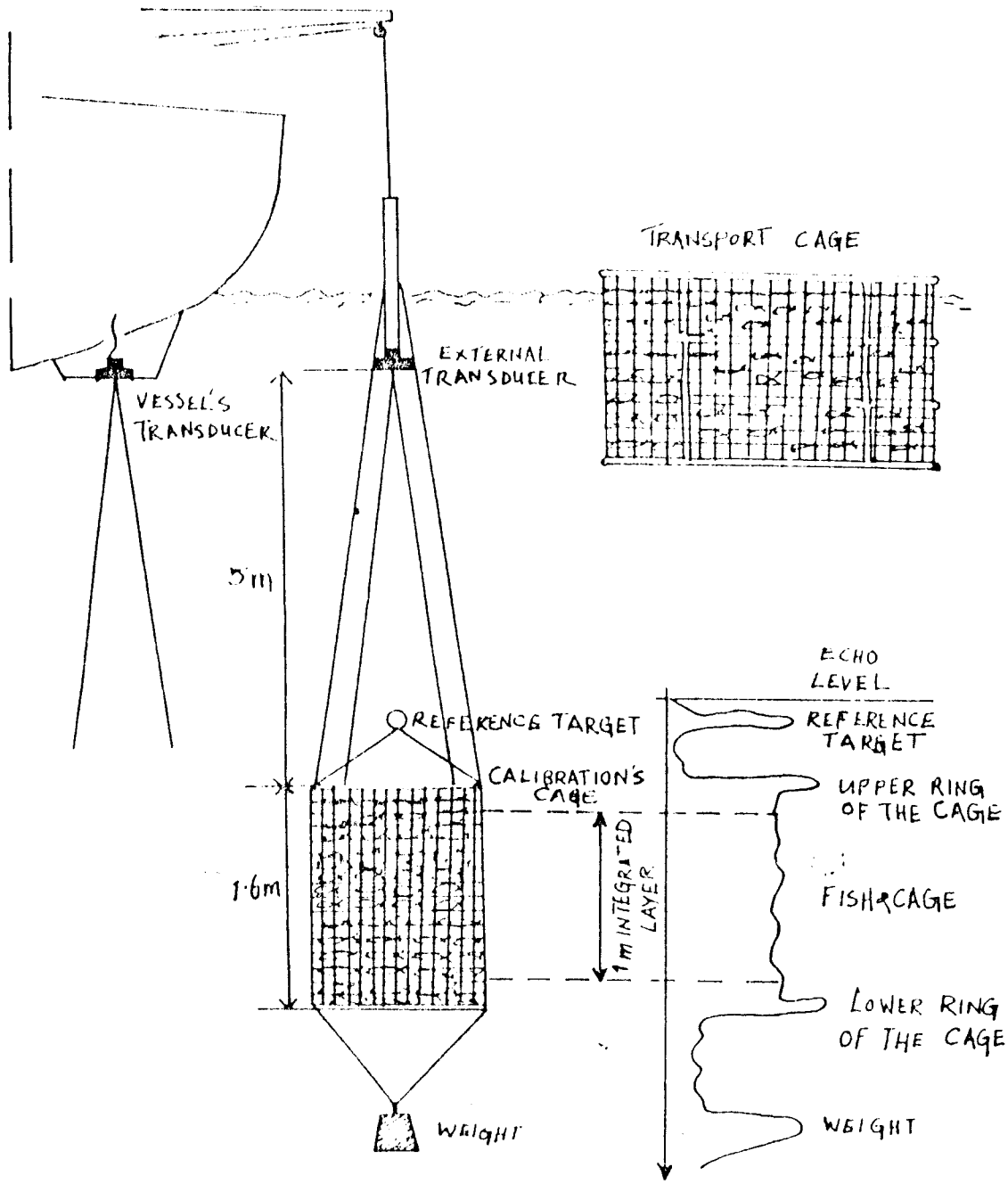


FIG. V-6 THE ARRANGEMENT FOR CALIBRATION OF THE ACOUSTIC SYSTEM ON LIVE FISH

After a number of replications of the experiment with different fish densities, the acoustic system constant in t/n mi^2 is calculated as follows :

$$C = \frac{\bar{d}}{\bar{m}}$$

where $\bar{d}$ = average density and $\bar{m}$ = mean integrator deflection.

Live fish calibration experiment was carried out onboard R.V. Rastrelliger belonging to the UNDP/FAO/Pelagic Fisheries Project and the calibration constant obtained for mackerel and sardine (Vittulo et al., 1980) is given in Table V-12.

ACOUSTIC SURVEY RESULTS

The Indo-Norwegian Project used R.V. M.O.Christensen, R.V. KALAVA and R.V. Varuna during the late fifties for qualitative studies using acoustic equipment. The survey of the fishing ground in the 75-100 m depth zone, particularly for kalava (Epinephelus spp.) was carried out by R.V. Varuna during 1962-'68 between Cape comarin and Karwar (Silas, 1969).

TABLE V-12

VALUES OF C, THE ACOUSTIC SYSTEM CONSTANT (t/n mi^2/mm or SCALE DIVISION REF. 1 n mi) WITH VESSEL TRANSDUCER

Settings									
QM gain (db)	November 1976	March-April 1977				March 1978	November-December 1978		
	Oil sardine	Mackerel	Mixed pelagic specimen	Oil sardine	Mackerel	Mixed pelagic species	Oil sardine	Machkerel	Mixed pelagic Species
10 x 10	700	270.00	30.60	91.84	160.40	47.34	175.92	435.02	127.49
20 x 10	70	27.00	8.06	9.18	16.04	4.73	17.42	43.51	12.74
20 x N[a]	7	3.78	1.13	1.29	2.24	0.66	1.39	3.48	1.02
10 x N	70	37.80	11.30	12.90	22.45	6.62	13.94	34.80	10.21

N refers to normal, the position of the 10 x normal switch of QM Mark II.

Source : (Vittulo et al., 1980)

The result of the survey brought out the abundance of threadfinbream and the lizardfish, Synodus indicus in the deeper zone at 101 to 179 m. The bathypelagic fishes Cubicepes netalensis and Chlorophthalmus agassizi were abundant at 180 to 450 m depth. The survey also generated useful information about the DSL in the Laccadives seas. Subsequently, during 1971-79, the vessels of the UNDP/FAO/Pelagic Fisheries Project, R.V. Rastrelliger and R.V. Sardinella conducted acoustic surveys and fishing experiments from Ratnagiri to Gulf of Mannar and estimated the standing stock of different fisheries resources (Anon., 1975).

The resources of mackerel and sardine in the area surveyed were estimated at 1 million tonnes of which 1/3 was appaarently mackerel.

The whitebait were most frequently observed at depth between 25 and 30 m and also in shallow waters close to the shore particularly along the southern coasts. Towards deeper water whitebaits concentration was rarely found beyond the 50 m depth. During day time dense shoals of whitebait were observed on or near the bottom while during the night they were found dispersed at the surface. The greatest abundance of whitebait was assessed in April-May and the quantity assessed for entire area of survey (07^{o} to 17^{o} N) was 1.5 million tonnes. In general, Anchoviella heterolove and A. bataviencis were the most dominant species in the stock.

Ribbonfish contributed on an average 6.9% to the total fish biomas in the surveyed area. The average standing stock of ribbonfish per coverage was estimated at 67,200 tonnes. The region from Ratnagiri to Capecomarin supports very high biomass of ribbonfish. The central

region from Mangalore to Quilon within the Ratnagiri-Capse comarin belt supports good biomass of ribbonfish even upto a depth of 80 m (Rao et al., 1977).

Acoustic surveys carried out by R.V. Dr.Fridtjof Nansen (Anon., 1975) in the northern Arabian Sea during 1975 revealed the existence of dense shoals of sardine, horse mackerel, raibow sardine, leiognathids and whitebait, close to surface mainly inside the 100 m depth contour. Out side the shelf a scattered layer of mesopelagic fish dominated by myctophids, juvenile trichiurids, Cubicepts, etc. was recorded between 150 m and 500 m depth during day, which migrated to the surface at dusk (Anon., 1975).

Acoustic surveys conducted by R.V. Soyomaru in northern Arabian Sea during 1975-76 confirmed the wide occurrence of catfishes, nemiperids, lizardfishes, sardine, Decapterus.spp. and squids in the shallow water areas. As the survey was mainly intended to cover the offshore waters, the echotraces of the shoaling pelagic fishes consisted chiefly of Auxis rochii, A. thazard and Symplectoteuthis oualaniensis (Yamanaka et al., 1976)

The acoustic observations made on Deep Scattering Layer (DSL) in the Lakshadweep sea by Mathew and Natarajan (1990) onboard FORV Sagar Sampada shwoed that the first symptom of descend of animals from the surface started as early as 0520 hrs and they travelled a distance

of 550 m at a velocity of 3.7 m per minute to reach the day time depth. A similar calculation was made for the acent also in which case the earliest symptom of ascent was noticed as early as 1435 hrs and travelled a distance of 420 m at a velocity of 2.04 m per minute. This study showed that the downward migration was faster.

Natarajan et al. (1994) conducted acoustic surveys during cruise number 19.20, 86 & 116 of FORV Sagar Sampada and estimated the fish biomass. The details of the areas, periods of surveys, species and quantity are reproduced in Table V-13.

The foregoing account tells in brief the fishery investigations carried out mainly in the Indian EEZ using acoustic methods. As a result of these investigations considerable advances have been made in our knowledge on the living resources and the Deep Scattering Layer. However, application of acoustioc methods for the detection, estimation and exploitation of fisheries resources is yet to be effected on a larger scale for want of expertise in the country. It is needless to say that due importance be given to the development of expertise required for the application of acoustics in fisheries research and development.

TABLE V-13

ESTIMATED FISH BIOMASS BY ACOUSTIC SURVEYS

Cruise No.	Period	Surveyed Area	Average packing densities	Estimated biomass (W = d A)	Major resources	Remarks
1	2	3	4	5	6	7
SS/19/86	22.7.86 to 27.7.86	8° 30'N to 13.30'N	8.04	434160 T	Cubiceps natalensis Gempylus serpens Kyphosis sp.	Calibration Constant C_2 in t/n, mi^2/mm is 1.327 t for all the cruises.
SS/20/86	19.8.86 to 9.9.86	6° 30'N to 15° 30'N 71° 00'E to 70° 00'E	2.73	172218 T	Priacanthus sp. Nemoterus sp. Epinnula sp.	"
SS/86/91	28.2.91 to 10.3.91	8° 00'N to 12° 00'N 71° 00'E to 74° 00'E	15.99	863460 T	Deepsea fishes, prawns and cephalopods	"
SS/116/93	22.12.93 to 10.1.94	11° 00'N to 21° 00'N 80° 00'E to 89° 00'E	2.59	132867 T	Perches, microphils Deepsea prawns	"

C = Calibration constant in t/n.mi^2/mm, d = Average packing density in t/n.mi^2, A = Area of fish concentration in n.mi^2, W = Total fish biomass in tons.

Source: (Natarajan et al., 1994)

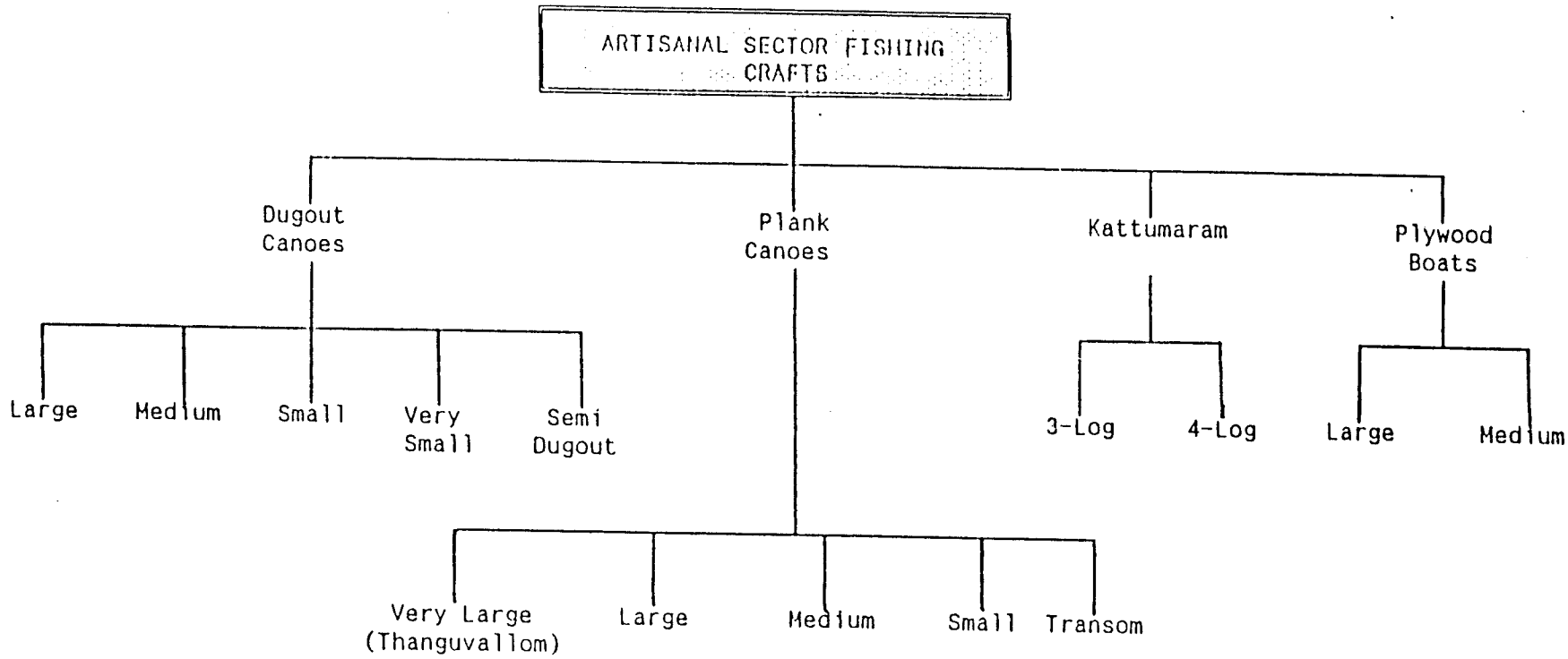
CHAPTER VI

TECHNOLOGICAL OPTIONS AND CAPITAL INVESTMENT

Fishing operations may be intensified according to location of fishing ground and according to technology or type of fishing gear. For historical as well as economic reasons, fishermen are locked into particular types of technology and locations of operation from which they don't leave, even if other types of gear and locations are more profitable. It is their psychology or tendency. There were wide differences among fishermen operating the same type of gear in different locations as well as among fishermen operating different types of gear in the same location. Even the fishermen operating the same type of gear in the same location had diverging cost and incomes (Panayotlu, 1985). However, cost-minimisation and profit maximisation are the twin inter-related objectives which influence the decision-making of the investor on choices of techniques to be adopted for any production process. Capital being a scarce resource to many of the fishermen, the choice of their fishing techniques at times drifts towards labour-intensive devices. Various technological options at different levels of investment are available to the marine fishermen of Kerala.

Suitable craft and gear combination is the basic requirement for the capture of fish. Fishing gear forms the actual tool/implement to catch fish, and craft is the floating platform for operating the gear to catch fish. A wide variety and type of fishing craft and gear (Chart VI - 1&2) have been used along our coast from time immemorial, each

CHART V-1



Notes:

1. Thanguvallam (large) is a recent craft, but basically a longer/larger version of what existed before.

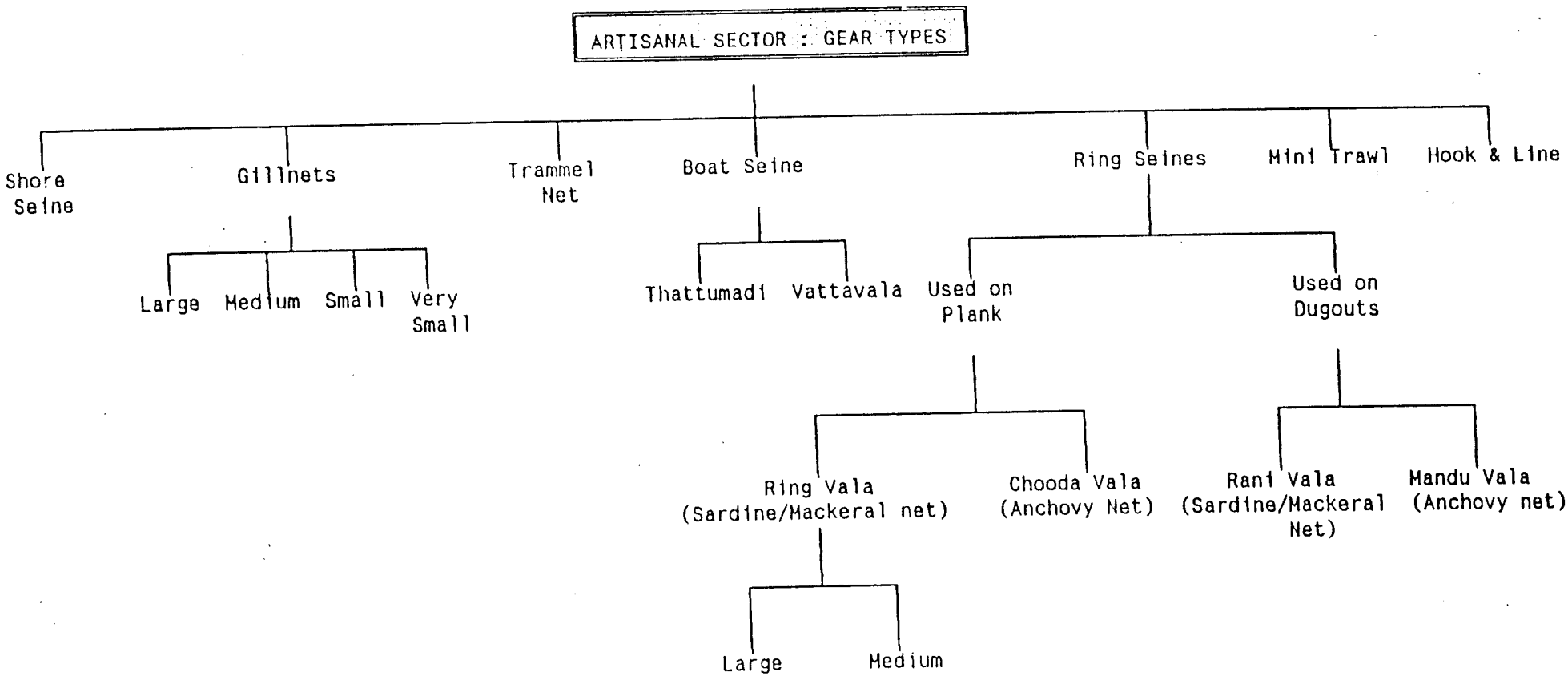
2. Plank-transom boat is a post-motorisation innovation based on traditional construction techniques. It has a transom as its name suggests while all other plank canoes are double ended. Used for gillnetting, hook & line and mini-trawl.

3. Plywood boats were introduced by the Kottar Social Service Society in Kanyakumari in 1982 and subsequently by SIFFS in Kerala.

4. All other craft have been in use prior to motorisation (1980).

5. Semi dugout is constructed differently, yet is just a variation of dugout-medium.

CHART V-2



Note:

Major artisanal gear rendered obsolete are

1. "Kollivala" boatseine operated by two dugouts displaced by ring-seines

2. "Thanguvala" or "Koruvala" encircling net used with plank canoe displaced by ring-seine.

type having been evolved through generations of trial and error methods (Govindan, 1983). However, the technology of motorisation of the existing traditional craft and introduction of mechanised boats is of recent origin.

CRAFTS:

Even though, the type of fishing craft used along the coast of Kerala are very wide with different regional names, all these can be grouped into few basic types. However, only those which are widely used like catamarans, canoes and Plank-built boats and mechanised boats have been included in this study.

CATAMARANS

The word "Catamaran" seems to have been originated from the Tamil word "Kattumaram" which literally means "logs tied together". Perhaps, it would have been the first floating platform used by the coastal fishermen (Menon, 1985). Further, it is the simplest form of a fishing craft that has been used by the fishermen of India and Sri Lanka.

The Catamaran used in the southern Kerala Coast (Trivandrum, Quilon) is made by lashing together 3 longs. Whereas from Kollengode from south to Mampally in north use 4 logs of catamaran. The size of the catamarans range from 4 m to 9 m OAL, with width ranging from 60 cm to 1.8 m. Depending upon its size, the requirement of capital investment ranges from Rs.4000 to 16,000. About 15,000 catamarans are under operation along Kerala Coast. Earlier catamarans used sails alone for propulsion and now OBM also is used.

PLANK-BUILT BOATS

Variations in design and construction of plank-built boats exist between different regions. These craft range in size from 8 m to 9.5m OAL and width of 1.75 to 2 m. The initial investment for these boats ranges from Rs.20,000 to 60,000. At present there are about 2000 non-mechanised and 3000 motorised plank boats operating along Kerala Coast. The life expectancy of a plank-built boat is about 7 years.

MECHANISED BOATS

The wooden boats of 8 to 12 m in length are widely used for trawl and gill net operations in the mechanised sector. The initial investment required is Rs.2 to 7 lakhs per boat. There are about 5000 mechanised crafts operating along Kerala Coast. Mechanised boats are constructed with timber, marine plywood, fibreglass and steel. Wooden boats have been so far the cheapest and most popular in Kerala.

DUGOUT CANOE

As the name implies this craft is made from a single log of wood. There is no keel for the craft, but the bottom is made thicker than the sides. The art of making a dug-out canoe can be compared to carving or sculpture, as these craft are beautifully shaped and fashioned and possess excellent lines. The size of the dug-out canoe depends on the size of the timbers available, which will restrict the length, beam and depth of the craft. They range in size from a tiny "one boy" canoe of 2 m OAL to large vallam of about 12 m OAL. Costing Rs.5000 to 50000 per boat. At present there are about 5000 dug-out canoes in the State. In the districts of Kasaragode and Calicut relatively more dug-out canoes are under operation.

GEARS

There are a number oof gears indigeneously developed by the fishermen for exploiting different fisheries in the coastal areas to suit local conditions. (Mohanrajan et al., 1985; Miller, 1990). The major type of gears employed in small scale fisheries of Kerala can be grouped under (i) Seine nets (ii) Hook and line (iii) Traps (iv) Gillnets (v) Trawlnets and (vi) Miscellaneous.

SEINE NETS

Boat seines and shore seines are the prominent seine nets prevalent in Kerala. The operation is by encircling a located shoal of fish with the help of a long wall of netting, equipped with floats on its upper margin on edge called the head rope and the weights or

sinkers on its lower margin edge called the foot rope. After the encircling, the trapped fish can be removed from the enclosure. Such nets operated from the shore (known as shore seines), are locally called as Karamadi in Kerala. If the fish shoals are away from the shore it may not be possible to catch with the help of shore seines. In such cases, one or two craft will carry the net and encircle the shoal of fish in the sea, and the net will be hauled on the craft itself. Such nets which are set/shot from a boat and hauled on to the boat are known as boat seines and locally called as Thattumadi.

HOOK AND LINE

The principle involved in hook and line fishing is to lure the fish to take a bait. Hooks are concealed in the bait and the fish gets hooked when it tries to vomit or spit out the bait. There are several types of line fishing, from a simple hand line to a much complicated long line which can either be set or drift and made to fish in any desired depth.

TRAPS

In modern fishing, fish traps appear to be losing importance. Traps can be made in various shapes and sizes using rigid materials such as wiremesh, welded mesh, or bamboo or netting materials. The opening or entrance to the trap is one way valve either conical in shape

or the inside of the opening is provided with flaps or flappers which will open inwards only, allowing the fish to enter the trap and prevent their escape. Traps used in Kerala are mainly basket traps and those made with roots of palmyra trees. Lobster traps are the most popular and important fish traps.

GILL NETS

Gill nets are the most important fishing gear widely used all along the Indian Coast. Various types of gill nets are in use, each type having its own regional importance and known by different regional designations. The gear is a long wall of netting, laid across in sea, either on the surface, mid water or bottom. The mesh size and spread depends on the species to be caught. When the fish tries to pass through the mesh opening, it gets caught at the gills. By adjusting the floats and weights, the net can be made to fish at any desired depth. The net can be allowed to drift with the water current or can be set to remain in a fishing ground. Gill nets are usually single walled and in some cases double walled or triple walled. Triple walled is more popular and known as 'trammel net".

TRAWL NETS

Trawl nets are essentially conical shaped bag nets, with long or short wings, depending on the design of the gear, which can be dragged in water, with the help of a boat either in the bottom,

midwater or surface, the mouth of the net being kept open by various devices, when it is being dragged. The principle involved is to drag the gear through water either on the bottom, surface or mid water and sweep the area, collecting all the fish which come in the way of the opening mouth of the net.

The prominent gear characteristics like mesh size, life expectancy and capital requirement of the important type of fishing gears along with local names operating along Kerala Coast are given in Table VI-1.

CHANGING PATTERN OF FISHING TECHNOLOGY

The marine fishing techniques used along Kerala has undergone frequent chanages. Some of the gears prominent a few year ago were either modified or displaced by new type of gears. Fishermen are very much conscious about the technical efficiency of these gears. The cotton thread used for the nets in earlier years were completely replaced by synthetic twines. Further, a recent technological improvement is the use of out board motors (OBM) for propelling catamarans and in board engines for plank-built boats.

The recent price escalation of certain varieties of fish also led changes in the fishing technology. For instance, the export demand of cuttlefish has induced the motorisation of traditional crafts in the country especially along the south west coast of Kerala.

TABLE VI-I

PROMINENT FEATURE OF IMPORTANT FISHING GEARS IN KERALA

Gear category	Local Name	Mesh Size	Av. No or pieces per unit	Life Expectancy	Capital Investment (Rs.)
I. SEINE NETS					
1. Shore Seine nets	Karamadi	8-10mm	1	5Yrs	60,000
2. Boat Seine	Thattumadi	10-15mm	2	5Yrs	10,000
II. HOOKS & LINE	Mattuvala	No.6-16	900-1000	2-3mon	4,000
III. GILL NETS					
1. Drift net	Ozhukkuvala	60-130mm	10	3-5Yr	1,00,000
2. Sardine net	Chalavala	20-30mm	3	2-3Yr	7,000
3. Anchovies net	Choodavala	15-18mm	2	3-4Yr	6,000
4. Mackerelnet	Eatchavala	30-35mm	4	3-5Yr	8,000
5. Prawn net	Chemmeen vala	40-50mm	4	3-4Yr	7,000
6. Lobster net	Trap	60-65mm	1	3-4Yr	4,000
7. Bottom set net	Thattuvala	140-150mm	1	3-4Yr	5,000
IV. TRAWL NETS					
1. Shrimp trawl	Chemmeenvala	15mm	1	6mon	7,000
2. Fish trawl	Thattumadi	20-30mm	1	2Yr	4,000
3. Pair trawl	High opening trawl	45mm	1	1Yr	40,000

CRAFT-GEAR Combinations

The fishing craft either operate with a specific type of net throughout the year of different types of net depending upon seasonal availability of different varieties of fish. In the mechanised sector, trawlers and gill netters operate the same gears throughout the year. However, in the artisanal and motorised sector the catamarans and plank-built boats have different types of gear combinations.

About 50% of the traditional fishing craft operating along Kerala Coast use wind energy for their mobility and more than 80% of the gears used by them are different types of gill nets. Many fishermen not having any craft also possess some pieces of gill nets with which they join the craft owners according to the seasonal requirement. Different types of specialised gillnets are used for different species of fish. Gill nets mainly used for catching sardine is widely being operated along the entire coast with different local names such as Chalavala, Eachavala, gylavala etc in different regions. The prawn nets operation is mostly restricted to the period from November - February. Bottom set gill nets operation varies from region to region, but mostly confined to January - May.

Details regarding the average trip time, actual fishing hours and distance of fishing ground for the prominent craft gear combinations are given in Table VI-2 and employment pattern and average annual fishing trips for each combinations given in Table VI-3.

TABLE VI-2

FISHING DETAILS OF SELECTED CRAFT-GEAR COMBINATIONS AT SELECTED CENTRES IN KERALA

egory	Trip Time Hours	Actual Fishing Hours	Depth of operation	Distance of Fishing ground (Kms)
ARTISANAL SECTOR				
Catamarans with				
Hooks & Lines	7	4.3	25-40	5-10
Boat seine	5	3	10-12	1-3
Anchovies net	3	2	10-20	1-4
Drift net	14	10	20-40	8-12
Sardine net	5	3	20-30	4-8
Prawn net	8	5	10-30	3-6
Lobster Trap	4	24	6-10	1-3
Thattu vala	4	24	35-40	7-10
Plank built boats with				
Shore seines	3	2	8-12	0-1
Sardine net	8	4	10-20	7-12
Drift net	12	8	40-45	12-15
Thallu vala	6	5	3-5	1-2
MOTORISED SECTOR				
Catamarans with				
Hooks and lines	8	4	50-55	14-18
Sardine net	6	4	10-20	7-12
Drift net	14	10	25-40	7-15
I.MECHANISED SECTOR				
Trawlers	10	6	30-50	15-20
Gill netters	14	8	30-50	15-20
Pair trawlers	12	6	40-50	15-25
Fish trawlers	12	8	35-50	15-25

TABLE VI-3

EMPLOYMENT PATTERN AND LABOUR SHARE IN DIFFERENT CRAFT-GEAR COMBINATIONS IN KERALA

Category	No. of crew	Crew Share per cent	Trips (annual)	Annual Employment (Man days)
I. ARTISANAL SECTOR				
1. Catamarans with Hooks and lines	1-4	40	240	600
2. Boat seine	6	35	80	480
3. Anchovies net	2-3	35	240	600
4. Drift net	3-4	35	150	525
5. Sardine net	2-3	35	120	300
6. Prawn net	2-3	35	80	200
7. Thattu vala	3-4	35	125	312
II. PLANK BUILT BOATS WITH				
1. Shore seines	20-35	40	180	4860
2. Sardine ent	5-6	35	240	1320
3. Drift net	5-6	35	170	935
III. MOTORIZED SECTOR				
1. Catamaran with Hooks and lines	3-4	35	240	840
Sardine net	2-3	35	240	600
Drift net	3-4	35	175	412
2. Plank built boat with sardine net	5-6	30	260	1430
IV. MECHANISED SECTOR				
1. Trawlers	6	30	220	1320
2. Gill netters	5	30	200	1000
3. Pair trawlers	12	30	100	2400
4. Fish trawlers	6	30	80	480

It may be seen that in the artisanal sector catamarans with hook and line or with anchovies net operate maximum number of days. For better utilization of craft and available man power, some other type of gear also are required for effective fishing through out the year. The annual employment, generated in terms of man days per unit is comparatively more in Catamarans boat combinations rather than plank-built boat combinations both in motorized and non-motorized sectors. In the mechanised sector maximum fishing operations per annum was undertaken by trawlers.

INITIAL INVESTMENT

The capital investment of a fishing unit varies with the size of craft, type of engine and the number and pieces of gear owned. Most of the fishing units in operation are old. There is considerable cost difference in the initial investment of old and new units. The resale value of the fishing units at the time of observation has been considered as initial investment. The age of the fishing equipment, category wise life span, wear and tear suffered during the course of operation and the general appreciation of some fishing units due to cost escalation in recent years are considered in assessing the capital investment on fishing equipments.

Some of the important craft - gear combinations in the traditional sector have been identified and the information on average capital investment on them at selected centres in Kerala coast is given in Table VI-4

TABLE VI-4

AVERAGE INVESTMENT OF DIFFERENT CRAFT - GEAR COMBINATIONS IN ARTISANAL SECTOR AT SELECTED CENTRES OF KERALA DURING 1992-93

Centres	Craft - gear combination	Average Investment Rs.	Total Rs.
Trivandrum	Catamaran	14,000	94,000
	Drift net	80,000	
Neendakara	Catamaran	7,000	12,000
	Hooks and lines	5,000	
Alleppey	Plank built canoe	14,000	20,000
	Gill net	6,000	
Cochin	Plank built canoe	13,000	
	Gill net	6,000	19,000
Calicut	Dug out canoe	20,000	
	Sardine net	10,000	30,000
Malapuram	Dug out canoe	15,000	
	Sardine net	7,000	25,000
	Prawn net	3,000	
Cannanore	Dug out canoe	20,000	80,000
	Ranivala	60,000	
Kasaragode	Dug out canoe	40,000	60,000
	Sardine net	20,000	

The technological options and investment range are very wide. The average capital investment for a catamaran units with a single type of gear varies from Rs.12,000/- for a hook and line unit at Neendakara to Rs.94,000/- for a drift net unit at Trivandrum. For plank-built boats, the investment range is Rs.19,000/- for a gill net unit at Cochin to Rs.20,000/- for another gill net unit of Alleppey.

The motorised units operate mostly the same type of gears operated by the artisanal units. However, the pieces of gill nets or the number of hook and line possessed by these units are comparatively more than the artisanal units. The average capital investment for different craft - gear combinations at selected centres for motorised and mechanised units are given in Tamble VI-5.

The investment option for a motorised catamaran unit ranges from Rs.56,000/- to Rs.1,50,000/- worked out at the prevailing rate during 1992-93. The average capital investment of a motorised plank-built boat comes about Rs.94,000/- at Kasaragode.

Trawlers and gill netters are the major mechanised units operating along Kerala Coast. Seasonal operation of pair trawlers and fish trawlers are also popular now a days. The average capital investment of a trawler works out at Rs.6,07,000/- and gill netter Rs.6,40,000 at selected centres.

The analysis indicated that several technological options with varying investment ranges are available to the marine fishermen of Kerala. Each type of craft - gear combination has its own merits and demerits. The co-existence of most of these innumerable techniques are imperative due to the seasonal nature of marine fisheries. However, the availability of detailed information on the cost and earnings and comparative economic efficiency of different methods of fishing are very

TABLE VI-5

AVERAGE INVESTMENT OF DIFFERENT CRAFT - GEAR COMBINATIONS IN MOTORISED AND MECHANISED SECTOR AT SELECTED CENTRES OF KERALA DURING 1992-93

Centres	Craft - gear combination	Average Investment Rs.	Total Rs.
I. MOTORIZED UNITS			
Trivandrum	Catamaran	17000	63000
	Engine	34000	
	Sardine net	12000	
Eranakulam	Catamaran	10000	51000
	Engine	34000	
	Hooks & Lines	7000	
Calicut	Catamaran	18000	149000
	Engine	31000	
	Drift net	100000	
Kasaragode	Plank built boat	40000	94000
	Engine	34000	
	Sardine	20000	
II. MECHANISED UNITS			
Needakara (Trawlers)	Mech.Boat	600000	607000
	Trawlnet	7000	
Ernakulam (Fish trawlers)	Mech.boat	600000	612000
	Fish trawl net	12000	
Cannanore (Gill netter)	Mech.boat	440000	640000
	Gill net	200000	

essential for the investors to decide the appropriate technology. However, the cost of the craft varies depending upon the size of the boat, HP of Engine and the type of gear selected.

CHAPTER VII

COSTS AND EARNINGS OF FISHING UNITS

The techno-economic performance and comparative efficiency of different types of fishing methods are determinent and decisive factors in the allocation of scarce resources. The production sector of marine fisheries consists of the artisanal, motorised and mechanised sub-sectors. The balanced growth of all these sectors should be taken care of in the development process. The options of different technologies are mostly based on profitability. (Compleman, 1976; Sathiadhas, 1989) Lack of detailed information on the economics of operations of different fishing methods is the present major lacunae in the selection of appropriate technology within each sector.

Seasonal operation of resource-specific gears depending upon the abundance of certain species is a common feature. Normally a catamaran unit has more than one gear. A clear picture about the profitability of a catamaran unit will emerge only by studying the annual costs and earnings of either a single gear or a combination of gears operated by them atleast for an year. However, the operational costs and earnings of some of the seasonal gears widely operated by catamarans such as boat seine, thattu-vala is worked out to assess the comparative economic efficiency among these least capital-intensive indigenous units.

SEASONAL ARTISANAL FISHING UNITS

PRAWN NET OPERATIONS BY CATAMARANS

The prawn net operation along Trivandrum Coast of Kerala is mostly confined to June-September coinciding with the availability of

P. indicus. The average operational costs and earnings of prawn net operation by catamaran at Poothura and Vizhinjam North centres of Trivandrum Coast have been given inTable VII-1.

The average initial investment of a catamaran with prawn net, works out at Rs.10,000. The average number of fishing trips during the season comes about 83. THe distance of the fishing ground is less than 4 km and average fishing hours per trip ranges from 2 to 5 hours. The average operational expenses of these units works out at Rs.18094 as against a gross revenue of Rs.25730. More than 90% of the operational expenses are the share of the wages of 2-3 crew members. P.indicus, Otolithus sp., Johnius sp., and silverbellies are the major species caught in these units. The net operating income for catamaran with Prawn net works out at Rs.7636 per season.

BOAT SEINE OPERATION BY CATAMARAN

Boat seine operation by catamaran is comparatively labour-intensive as it requires about 6 crew. The operation of this net is mainly confined to May-September period. The operational cost and earnings of seasonal boat seine operation by catamaran at Paravoor centre in Quilon Coast of Kerala is given in Table VII-2

The actual number of fishing days ranges from 70 to 90 days during the season. The operational cost works out at Rs.1,25,920/- per season and Rs.1574/- per trip. The major varieties of fish caught in these units are whitebaits, ribbonfish and rainbow sardines. The average catch per unit per season works out at 19600 kg realising a gross revenue of Rs.2,00,800/- The catch per trip of a catamaran operating boat seine is 245 kg realising a gross revenue of Rs.2260. The net operating income of these units works out at Rs.54880 per season and

TABLE VII-1

OPERATIONAL COSTS AND EARNINGS OF SEASONAL PRAWN NET BY CATAMARANS DURING JUNE - SEPTEMBER ALONG KERALA COAST

Item		Season	Per-Trip
Actual No. of fishing days		83	-
Oper. Expenditure (Rs.)			
Labour		15438	186.00
Repair & maintenance		1328	16.00
Auction charges		830	10.00
Other expenditure		498	6.00
	Total	18094	218.00
Catch & Revenue (Q.Kgs. V.Rs.)			
P. *Indicus*	Q	83	1.00
	V	10790	130.00
Otolithus sp.	Q	83	1.00
	V	1494	18.00
Johnius Sp.	Q	83	1.00
	V	2490	30.00
Silverbellies	Q	83	1.00
	V	498	6.00
Miscellaneous	Q	581	7.00
	V	10550	126.00
Total	Q	913	11.00
	V	25730	310.00

TABLE VII-2

OPERATIONAL COSTS AND EARNINGS OF SEASONAL BOAT SEINE (THATTUMADI) BY CATAMARANS DURING JANUARY - MAY

Item		Season	Per-Trip
No. of fishing days		80	-
Operational expenses (Rs.)			
Labour		109920	1374.00
Repair & maintenance		4800	60.00
Auction charges		8000	100.00
Other expenses		3200	40.00
Total		125920	1574.00
Catch and revenue (Q.Kg V.Rs)			
Whitebaits	Q	7200	90.00
	V	57600	720.00
Ribbonfish	Q	8000	100.00
	V	100000	1000.00
Rainbow sardine	Q	1600	20.00
	V	9600	120.00
Others	Q	2800	35.00
	V	33600	420.00
Total	Q	19600	245.00
	V	200800	2260.00

Rs.686 per trip.

CATAMARAN OPERATING SEASONAL BOTTOM-SET GILL NETS

Thattumadi and lobster net are the two prominent bottom-set gillnets widely operated along Kerala coast in different seasons. With regard to the operation of these bottom set gillnets, fishermen leave the shore in the evening and set the net in the fishing ground and return by night itself. Next day morning about 8 A.M., they go to the ground, collect the catch and return to the shore. The net will be removed only on saturdays and if any repairing is required it will be done on sundays and again it will be set in the night. During week days when the net is in the ground, if any damage is noticed, that particular piece will be removed, repaired and replaced next day.

The average operational expenses and earnings of Thattumadi operation at Puthiathura and lobster net at Puzhiyoor in Trivandrum Coast have been worked out and given in Table VII-3 and VII-4.

The average fishing days comes about 125 for Thattumadi and 150 for lobster net operations by catamaran. Carangids, pig-face breams and reef-cod are the major varieties caught in Thattumadi units and lobster and pig-face breames in lobster net units.

The gross earnings of a Thattumadi unit during the season works out at Rs.83750 as against the operational expenses of Rs.59,250. Maximum operational expenses is constituted by labour charges which is nothing, but sharing the net revenue among crew members keeping

TABLE VII-3
OPERATIONAL COSTS AND EARNINGS OF SEASONAL THATTUMADI BY CATAMARANS DURING APRIL - OCTOBER

Item			Season	Per-Trip
No. of Fishing days			125	-
Operational expenses				
Labour			48000	384-00
Repair maintenance			5000	40-00
Auction charges			3750	30-00
Others			2500	20-00
	Total		59250	474-00
Catch & Revenue (Q.Kg,V.Rs.)				
Caranx		Q	625	5-00
		V	13755	110-00
Pig-face breams		Q	1875	15-00
		V	41350	330-00
Reef-cod		Q	1875	15-00
		V	22500	180-00
Others		Q	625	5-00
		V	6250	50-00
	Total	Q	5000	40-00
		V	83750	670-00

ıide a share to craft and gear. The average catch per trip per unit ımes about 40 kg for Thattumadi units and 8.5 kg for lobster net units against the gross revenue of Rs.670 and Rs.370 respectively. About 1% of the revenue in Thattumadi units is realised from pig-face breams ıd about 75% of the gross revenue lobster net unit from lobsters.

The net (Final) operating income for the seasonal operations o thattumadi comes about Rs.24500/- and lobster net Rs.12300/- The me per trip being Rs.196 and Rs.82 respectively.

CATAMARAN OPERATING A SINGLE GEAR THROUGH OUT THE YEAR

Some catamarans operate single type of gear throughout the year. e gear which can be utilized effectively to a reasonable extent through the year along Kerala Coast are anchovies net, Sardine net, drift l net and hook and line. With less capital investment, Wider fishing ıge and higher employment opportunities are obtained with these type gears.

The average operational cost and earnings of a catamaran erating anchovies net at selected centres in Quilon Coast is given in ble VII- 5.

The number of average annual fishing days comes about 240 and peak season is confined to July-September. The operation of this is restricted within a distance of 4 km from the shore. Whitebaits,

TABLE VII-5

OPERATIONAL COSTS AND EARNINGS OF SEASONAL ANCHOVIES NET BY CATAMARANS (9 MONTHS)

Item		Season	Per-Trip
No. of fishing days		240	-
operational expenses (Rs.)			
Labour		50400	210.00
Repair & maintenance		3840	16.00
Auction charges		3360	14.00
Other expenses		2400	10.00
	Total	60000	250.00
Catch & Revenue : (Q.Kg V.Rs)			
Whitebaits	Q	8400	35.00
	V	64800	270.00
Sardines	Q	960	4.00
	V	7200	30.00
Silverbellies	Q	480	2.00
	V	2400	10.00
Others	Q	480	2.00
	V	2400	10.00
Total	Q	10320	43.00
	V	76800	320.00

rdines and silverbellies are the major varieties of fish caught in this ar. The average operating expenses per trip works out at Rs.250 as ainst a gross revenue of Rs.288. The gross revenue per annum works t at Rs.76800/- as against the operational cost of Rs.6000. The net erating income works out at Rs.16800 per annum.

Hook and line is another gear opoerated throughout the year many catamarans. Quality fishes like tuna, caranx, cat fish, seer sh, reef cod and cuttle fishes are caught by this gear. The average nual fishing days of a Catamaran unit with hook and lines at selected ntres in Trivandrum coast comes about 220. The average catch per trip rks out at 18 kg with a gross revenue of Rs.372 (Table VII-6).

The average annual catch is 3960 kg with gross revenue of 81840. Cuttle fishes and seer fish are the major varieties earning imum revenue for the non-motorized catamaran operating hook and

The average catch and earnings of a non-motorized catamaran rating sardine gill net at Thangassery landing centre is given in e VII-7.

The major catch components in these units are other sardines goat fish. On an average each unit operate about 220 days in a with total catch of 5178 kg valued at Rs.41424/-

TABLE VII-6

AVERAGE CATCH AND EARNINGS OF A CATAMARAN WITH HOOKS & LINES

Variety	Annual Catch Kg.	Annual Revenue Rs.	Per-Trip Catch Kg.	Per-Trip Revenue Rs.
1. Tuna	660	7920	3	36
2. Caranx	440	6600	2	30
3. Cat fish	220	2200	1	10
4. Seer fish	660	19800	3	90
5. Reef cod	660	7920	3	36
6. Pig-face breams	880	17600	4	80
7. Cuttle fishes	220	17600	1	80
8. Others	220	2200	1	10
Total	3960	81840	18	372

TABLE VII-7

AVERAGE CATCH AND EARNINGS OF A CATAMARAN WITH SARDINE GILL NET (CHALA VALA)

Variety	Annual		Per Trip	
	Catch Kg	Revenue Rs.	Catch Kg	Revenue Rs
Other sardines/ clupeids	3654	29232	17	132.00
Goat fish	524	4000	2	18.00
Others	1000	8192	5	38.00
Total	5178	41424	24	188.00

Drift gill net operation is also carried out in all seasons by non-motorized catamarans. The average catch and earnings of these units operating at of Trivandrum coast of Kerala is given in Table VII-8

The annual fishing days ranges from 125 to 175. Quality fishes like, caranx, barracudas, seer fish, pig-faced breams and pomfrets are caught in substantial quantity by these units. The annual catch per unit works out at 7359 kg with a gross revenue of Rs.86700 the catch per trip being 49 kg with Rs.578 as gross revenue. Tuna forms the maximum catch and revenue of these units.

The annual income and expenditure statement of non-motorized catamaran operating various single type of gears at selected centres of Trivandrum coast is given in Table VII-9.

The initial investment varies from Rs.11000 to 1,10,000 for operating anchovies net to drift gill net by catamarans. The annual fixed cost portion of a catamaran unit with anchovies net works out at Rs.4650, sardine gill net Rs.5472, drift gill net Rs.43500 and hook and line Rs.9700. The annual operational cost varies from Rs.29350/- for sardine gill net to Rs.62794/- for hook and line. The net operating income varies from Rs.12074/- for sardine gill net to Rs.25100/- for drift gill net unit. The annual net profit of catamaran operating ahchovies net throughout the year works out at Rs.12150/- sardine gill net

TABLE VII-8

AVERAGE CATCH AND EARNING OF A CATAMARAN WITH DRIFT GILL NET

Variety	Annual		Per Trip	
	Catch Kg	Revenue (Rs.)	Catch Kg	Revenue Rs.
Tune	2250	22500	15	150
Mackeral	750	7500	5	50
Caranx	600	9000	4	60
Barracudas	750	12000	5	80
Seerfish	450	9000	3	60
Pig-face breams	300	3000	2	20
Reef cod	450	2700	3	18
Sharks	300	3000	2	20
Pomfrets	300	6000	2	40
Others	1200	12000	8	80
Total	7350	86700	49	578

TABLE VII-9

ANNUAL INCOME AND EXPENDITURE STATEMENT OF CATAMARANS WITH SINGLE GEAR AT SELECTED CENTRES (1992-93)

Item		Anchovies net	Sardine net	Drift gill net	Hooks & lines
I.	INITIAL INVESTMENT (Rs.)				
1.	Catamaran	5000	6000	10000	8000
2.	Gear	6000	7000	100000	6000
	Sub Total	11000	13000	110000	14000
II.	ANNUAL FIXED COST (Rs.)				
1.	Depreciation				
	Catamaran 20%	1000	1200	2000	1600
	Gear (25% to 100%)	2000	2232	25000	6000
2.	Interest (15%)	1650	1950	16500	2100
	Sub Total	4650	5472	43500	9700
III.	OPERATIONAL COSTS (RS.)				
1.	Labour share	50400	24150	50200	57144
2.	Repair & Maintenance	3840	1400	5000	600
3.	Auction charges	3360	2120	4280	4210
4.	Other expenses	2400	1680	2120	880
		60000	29350	61600	62794
IV.	ANNUAL TOTAL COST (RS.)	64650	34822	105100	72494
V.	ANNUAL CATCH (KG.)	20640	10256	14700	7920
VI.	GROSS REVENUE (RS.)	76800	41424	86700	81840
VII.	NET OPERATING INCOME (VI-III)	16800	12074	25100	18046
VIII.	Net Profit (Rs.)VI-IV	+12150	+ 6602	-18400	+ 9346

Rs.6602/- and hook and line Rs.9346 However the catamaran operating drift gill net incur a net loss of Rs.18400 per annum. The loss for these units is mainly due to the high initial investment of Rs.1,00,000/- towards the nets alone and comparatively less number of annual fishing days.

The prominent gear combinations of catamaran unit differ from region to region. In general, in all regions catamaran units operate a pelagic gill net and another bottom set gill net although it is called by different local names in different regions. The gear combination at selected centres with the initial investment and average annual fishing trips are given in VII-10.

The investment varies from Rs.27,000 at Eravipuram to Rs.90,000 at Marianad. The annual fishing trip for these units are comparatives higher than the catamaran operecting a single type of gear throughout the gear which varies from 220 trips at Marianad to 268 at Azheekal.

The annual income and Expenditure statement of Catamaran operating with a combination of 3 types of gill nets at different centres along Kerala coast is given in Table VII-11.

The annual operational expenses vary from Rs.50340 at Eravipuram to Rs.1,68,560 at Marianad. The labour share alone constitutes more than 85 per cent of the operational costs of these units at all the selected centres. The annual fixed cost ranges from Rs.11316 at Eravipuram to Rs.40832 at Marianad. The annual total cost for the

TABLE VII-10

COMBINATIONS OF GILL NETS IN CATAMARAN UNITS - AVERAGE INITIAL INVESTMENT & ANNUAL TRIPS AT DIFFERENT CENTRES DURING 1992-93

Centre	Craft-gear combination	Initial Investment per item	Total Rs.	Annual fishing trips
1. Poonthura (Trivandrum District)	Catamaran	15000		
	Rani vala	7000		
	Kolli vala	6000		
	Chooda vala	3000	31000	257
2. Marianad (Trivandrum District)	Catamaran	20000		
	Kara vala	50000		
	Thangu vala	10000		
	Vatta vala	10000	90000	220
3. Eravipuram (Quilon District)	Catamaran	13000		
	Koru Vala	6000		
	Mandu Vala	5000		
	Chooda vala	3000	27000	232
4. Azheekal (Quilon District)	Catamaran	14000		
	Chooda vala	5000		
	Chala vala	7000		
	Eacha vala	7000	33000	268

TABLE VII-11

ANNUAL INCOME AND EXPENDITURE STATEMENT OF CATAMARANS WITH COMBINATIONS OF GILL NETS AT DIFFERENT CENTRES DURING 1992-93

Item		Poonthura	Marianad	Eruvaipuram	Azheekal
I.	INITIAL INVESTMENT Rs.				
	Craft	15000	20000	13000	14000
	Gears	16000	70000	14000	19000
	Sub Total	31000	90000	27000	33000
II.	ANNUAL FIXED COST Rs.				
	Depreciation				
	Craft (20%)	3000	4000	26000	2800
	Gears (33.3%)	5332	22332	4666	6332
	Interest (15%)	4650	13500	4050	4950
	Sub Total	12982	40832	11316	14082
III.	OPERATIONAL COSTS Rs.				
	Labour	45400	152120	44100	83140
	Repair & Maintenance	2400	3440	1600	2960
	Auction charges	3900	7400	3000	5500
	Other charges	3720	3600	1640	3500
	Sub Total	55420	168560	50340	95100
IV.	Annual total cost Rs. (II + III)	68402	209392	61656	109182
V.	Annual catch (Kg)	15420	51040	14848	22312
VI.	Gross Revenue (Rs.)	78128	244640	72384	136680
VII.	Net Operating Income (VI - III) Rs.	22708	76080	22044	41580
VIII.	Net Profit (VII - II) Rs.	9736	35248	10728	27498

operation of catamaran unit works out at Rs.68402 at Poonthura Rs.2,09,392 at Marianad Rs.61656 at Eravipuram and Rs.1,09,182 at Azheekal. Since the catamaran unit has to meet the annual fixed cost irrespective of their fishing operations, the net operating income was also worked out and it ranges from Rs.22044 at * to Rs.76,080 at Marianad.

PLANT-BUILT BOATS OPERATING DIFFERENT GEARS IN THE ARTISANAL SECTOR

Next to Catamarans the Plank-built boats locally called as "Vallams" or "Kettuvallams" are widely operated for marine fishing along Kerala coast. There are about 1700 plank built boats operating along this coast. The shore seine operations, here and there along the coast is exclusively carried out by these crafts. In addition to the usual operation of innumerable gill nets along the entire coast these boats operate mini trawl net (Thallu madi) in the near shore areas. The annual costs and earnings of plank built boats operating shore seines, gill nets and mini-trawl nets at representative centres like Chaliyam in Calicut District, Saudi in Ernakulam District Chettikadavu in Alleppey District and Marianad in Trivandrum District are discussed below.

The combination of plank built boat with different types of nets and their average investment and annual fishing days are given in Table VII-12

* ERAVIPURAM

TABLE VII-12

PLANKBUILT BOATS WITH DIFFERENT GEARS-INITIAL INVESTMENT AND ANNUAL FISHING TRIPS AT DIFFERENT CENTRES DURING 1992-93

Centre	Craft-gear combination	Initial investment per Item	Total Rs.	Annual fishing trips
1. Chaliyam (Calicut District)	Plankbuilt boat Shore seine	16000 60000	76000	180
2. Saudi (Ernakulam District)	Plankbuilt Sardine net	40000 20000	60000	240
3. Chettikkadavu (Alleppey District)	Plank built Ring Seine	36000 90000	126000	210
4. Marianad (Trivandrum District)	Plank built Thallumadi (Mini trawlnet)	36000 4000	40000	265

The average capital requirement for acquiring a plank built boat ranges from Rs.16,000 for shore seine operations at Chaliyam to Rs.40,000 for operating sardine gill net at Saudi. The average cost of a net ranges from Rs.4,000 for Thallumadi at Marianad to Rs.90,000 for Ring Seine at Chettikkadavu. The initial investment of a plank built boat unit ranges from Rs.40,000 to 1,26,000 for different gear combinations. The number of annual fishing trips ranges from 180 for a shore seine unit at Chaliyam to 265 for a Thallumadi unit at Marianad.

As seen from Table VI-13, the annual fixed cost (depreciation for craft and gear and interest on initial investment) varies from Rs.15,200 for a Thallumadi unit at Anjengo to Rs.44100 for a Chooda vala unit at Blangad. The annual operational cost ranges from Rs.5500 for

a Thallumadi unit to Rs.1,55,772 for a shore seine unit. Just like the non-motorized catamaran operating different gears, here also labour charge accounts for more than 80 per cent of the operational costs. The average annual expenditure works out at Rs.1,82,372 for shore seine unit at Chellanam Rs.1,11,880 for sardine gill net unit at Quilandi Rs.1,45,330 for Choodavala at Blangad and Rs.69700 for Thallumadi units at Anjengo. The net opeerating income

TABLE VII-13

ANNUAL INCOME AND EXPENDITURE STATEMENT OF PLANK-BUILT BOATS OPERATING DIFFERENT GEARS AT SELECTED CENTRES DURING 1992-93

	Item	Shore-Seine (Chellanam)	Sardine Gill net (Quilandi)	Chooda-Vala (Blangad)	Thallu-madi (Anjengo)
I.	INITIAL INVESTMENT	76000	60000	126000	40000
II.	ANNUAL FIXED COST Rs				
	Craft (20%)	3200	8000	7200	72000
	Gear 20% to 30%	12000	6600	18000	2000
	Interest (15%)	11400	9000	18900	6000
	Sub Total	26600	23600	44100	15200
III.	OPERATIONAL COSTS Rs.				
	Labour share	145572	73040	85430	44700
	Auction charges	4400	6240	6600	3600
	Repair Maintenance	4000	7400	7000	5000
	Other expenses	1800	1600	2200	1200
	Sub Total	151772	88280	101230	54500
IV.	AVERAGE ANNUAL COST	182372	111880	145330	69700
V.	ANNUAL CATCH (Kg)	39600	37920	26880	5300
VI.	GROSS REVENUE	218160	124800	153300	76850
VII.	NET OPERATING INCOME	62388	36520	52070	22350
VIII	NET PROFIT Rs	35788	12920	7970	7150

ages from Rs.22,250 to 52,070 per annum for different gears. The nual net profit is found to be Rs.7150 for Thallumadi unit, Rs.7970 r Choodavala unit, Rs.12,920 for sardine gill net unit and Rs.35,788 r shore seine unit.

Although shore seine unit earns maximum net operating income d profit compared to other gears, its number is gradually declining ll along the coast of Kerala. Shore seine operation required 30 to 50 abourers and their earning share works out hardly about Rs.20 per head er fishing day. The non-availability of regular labourers for this low eturns is perhaps tthe major reason for the declining of these units.

II. ECONOMICS OF MOTORIZED FISHING UNITS

The process of motorisation of country craft started in Tamilnadu n early eighties even though experimental projects on motorisation were tried much earlier (Jacob et al., 1985) Experiments conducted on motorisation of country craft under the Indo-Norwegien project in mid fifties found that the programme would not be feasible. In 1970, under Indo-Belgium Fisheries Project about 100 catamarans were fitted with outboard engines at Muttom in Kanyakumari District (Gillnet, 1981). In 1974, the Marianad Fisheries CO-operative society in Trivandrum District initiated a similar experiment. Unlike in Gujarat, where motorisation of country craft started in the fifties, the experiments in Kanyakumari district in Tamilnadu and Trivandrum District in Kerala were not a success (Balan et al., 1989). However motorisation of country craft picked up very well from the eaarly eighties due to the high catch rates of cuttle fish and its high unit value realisation due to export demand (Sathiadhas, 1982). Now the number of motorised craft is continuously increasing. Studies show that about 10 percent of catamarans and 19

percent of the other country crafts of Kerala were motorised so far.

Motorised catamarans operating Gillnet at Muttam and Vattavala at Neendakara and motorised plank built boats operating sardine gill net at Puduvaippu and Thattumadi at Madapally were selected for indepth study. The average initial investment of a motorised catamaran operating Gill net comes about Rs.51000 and the same operating Vattavala comes about Rs.1,49,000 (Table VII-14).

TABLE VII-14

MOTORISED COUNTRY CRAFTS WITH DIFFERENT GEARS - INITIAL INVESTMENT AND ANNUAL FISHING TRIPS AT DIFFERENT CENTRES DURING 1992-93

	Centre	Craft-gear combination	Initial investment Per Item	Total Rs	Annual fishing trips
1.	Marianad (Trivandrum)	Catamaran	10000		
		Engine	34000	51000	243
		Gill Net	7000		
2.	Neendakara (Quilon)	Catamaran	15000		
		Engine	34000	149000	195
		Vattuvala	100000		
3.	Puduvaippu (Ernakulam)	Plank Built Boat	40000		
		Engine	34000	94000	260
		Sardine gill net	20000		
4.	Madapally (Calicut)	Plank Built Boat	46000		
		Engine	34000	180000	220
		Thattumadi	100000		

The average annual fishing trips range from 195 to 243 for Vattavala and GIInet of Catamaran units respectively. Similarly the motorized plank built boat operating sardine gill net requires an average investment of Rs.94000 and for Thattumadi Rs.1,80,000. THe average annual fishing trips of motorized P.B. boats range from 220 for Thattumadi unit to 260 for sardine gill net unit.

The annual income and expenditure statement of motorized catamaran and plank built boat operating different gears at selected centres is given in Table VII-15.

The annual fixed cost of a catamaran unit ranges from Rs.24484 operating hooks and lines at Vizhinjam to Rs.56684 operating Ringu vala at Parappanamgad. The annual fixed cost of P.B. Boats operating sardine gill net at Edavanakad works out at Rs.40,034 as against Rs. 67534 for operating Ringuvala at Puthenthura. The operational expenditure varies from Rs.111210 to 141400 per annum for catamaran unit and Rs.147400 to 224000 for P.B. boat unit. All types of motorized unit observed are running on profit. Net operating income ranges from Rs.41880 to 60620 for catamaran unit and Rs.40840 to 79160 for P.B. boat unit. However the highest net profit of Rs.17396 per annum is seen for motorized catamaran operating hook and line. Among the motorized P.B. boats the RInguvala units earns Rs.11,626 per annum as net profit.

TABLE VII-15

ANNUAL INCOME AND EXPENDITURE STATEMENT OF MOTORIZED UNITS AT SELECTED CENTRES DURING 1992-93

Item	Cata marans Hooks & lines (vizhinjam)	Cata marans Ringu vala (Puthen thura)	Plank Built Boat Sardine gill net (Edavana-kad)	Plank Built Boat Ringu vala (Parappa namgadi)
Initial Investment Rs.	51000	149000	94000	18000
Annual Fixed cost Rs.				
Depreciation				
Craft @ 20%	2000	3000	8000	9200
Engine @ 33%	11334	11334	11334	11334
Gear @ 20-50%	3500	20000	6600	20000
Interest @ 15%	7650	22350	14100	27000
Sub Total	24484	56684	40034	67534
Operational costs Rs.				
Labur share	85160	108000	107000	170300
Fuel cost	17010	17500	18200	30800
Repairing and maintenance	1000	3500	12700	6000
Auction charges	6000	9600	6500	13500
Other charges	1440	2800	3000	3400
Sub Total	111210	141400	147400	224000
Annual Total cost Rs.	135694	198084	187434	291534
Annual catch Rs.	14580	30420	57720	42240
Gross Revenue Rs.	153080	202020	188240	303160
Net operating Income Rs.	41880	60620	40840	79160
Net profit Rs.	17396	3936	806	11626

Mechanised boats at Calicut set out for fishing by about 4 A.M. and return to the shore between 2 to 5 P.M. The number of crew in each boat ranges from 6 to 8. The net (mixture madi) looks like the usual trawlnet with a bigger mesh size costing around Rs.10,000/-

The average operational costs and earnings of seasonal fish trawl units at calicut during Sep-Dec 1992 have been given in Table VII-16.

The average actual fishing days per unit works out at 82 for (September-December 1992) season. The average operating expenses per trip comes to about Rs.2130. Wages and fuel expenditure are the most important constituents of operating costs. The average fuel expenditure per trip works out to Rs.800 with diesel requirement of about 80 litres per trip. Wages to the crew is proportional to the catch as sharing system is followed in these units. The income after deducting the running costs such as fuel expenses, auction charges and other day to day expenses is divided into three shares. The owner of the unit gets two shares for the boat and net and remaining portion is equally divided among the crew as wages.

Cuttle fish, thread fin breams, lizard fish and reef cod are the major varieties of fish caught by these units. The average catch per trip during the season,works out to 930 Kg. and gross revenue at Rs.4220. About 50 per cent of the gross earnings is from cuttle fish catches. The success of fish trawl operation in Neendakara region highly depends on the availability of cuttle fishes. The net operating income per trip works out to Rs.2090.

TABLE VII-16

OPERATIONAL COSTS AND EARNINGS OF A SEASONAL FISH TRWL UNIT AT NEENDAKARA DURING SEPTEMBER-DECEMBER 1992

	Item		Per Trip	Per Season
I.	Operational costs Rs.			
	Labour		1080	88560
	Fuel		800	65600
	Auction charges		100	8200
	Repair and maintenance		60	4920
	Other expenses		90	7380
	Total		2130	174660
II.	Catch & revenue (Q.Quantity V.Value)			
	Cuttle fish	Q	100	8200
		V	2000	164000
	Thread fin breams	Q	250	20500
		V	750	61500
	Lizard fish	Q	400	32800
		V	600	49200
	Reef cod	Q	100	8200
		V	500	41000
	Others	Q	80	6560
		V	370	20340
	Total	Q	930	76260
		V	4220	346040
III.	Net operating income Rs.		2090	171380
VI.	Average No. of fishing Trips		-	82

SHRIMP TRAWLERS AT SELECTED CENTRES

There are at present about 5026 trawlers operating along Kerala coast and 50 per cent of the total marine catch is accounted by them. Data on the daily catch, revenue and cost structure have been collected systematically for a period of one year at Calicut, Ernakulam and Neendakara during April 1992 to March 1993. Most of the boats under operation at the time of investigation were old and had undergone lot of repairs and replacements over the years. However, for the present analysis, the capital requirement for a new trawl unit 1992 has been considered as the initial investment.

CATCH AND REVENUE

The specie-wise average catch and revenue of trawler at calicut have been worked out and presented in Table VII-17.

Silver bellies and clupeids dominate in the catch and prawns dominate in revenue earned by these units. Prawns form about 6 per cent of the total catch but the revenue earned constitutes about 25 per cent of the gross revenue. It is interesting to note that the bye catches of trawlers at Calicut earns about 75 per cent of the gross revenue. The average catch per trip works out to 257 kg realising a gross revenue of Rs.3168. The average number of fishing trips per annum for the trawlers at Calicut comes to 243. The catch per unit per annum is estimated as 62.45 tonnes earning a gross revenue of Rs.769824/-

TABLE VII-17

AVERAGE CATCH AND EARNINGS OF A TRAWLER AT CALICUT DURING 1992-93

Variety	Per Trip		Annual	
	Catch Kg.	Revenue Rs.	Catch Kg.	Revenue Rs.
Prawns	16	800	3888	194400
Cuttle fish	10	350	2430	85050
Rays	6	50	1458	12150
Clupeids	50	400	12150	97200
Goat fishes	18	160	4374	38880
Croakers	4	40	972	9720
Carangids	18	288	4374	69984
Silver bellies	94	400	22842	97200
Seer fishes	3	140	729	34000
Barracudas	7	140	1701	34000
Thread fin breams	8	80	1944	19440
Other perches	20	300	4860	72900
Others	3	20	2430	4860
Total	257	3168	62451	769824

For the trawlers at Ernakulam Silver bellies, prawns, croakers, rays and thead fin breams are the dominent species in the catch (Table VII-18).

TABLE VII-18

AVERAGE CATCH AND EARNINGS OF A TRAWLER AT ERNAKULAM DURING 1992-93

Variety	Per Trip		Annual	
	Catch Kg.	Revenue Rs.	Catch Kg.	Revenue Rs.
Prawns	55	2200	13200	528000
Cuttle fish	3	90	720	21600
Rays	37	170	8880	40800
Croakers	50		12000	48000
Ribbon fish	5	20	1200	4800
Carangids	25	150	6000	36000
Silver bellies		240	14400	57600
Thread fin breams		200	7920	48000
Other perches	15	180	3600	43200
Barracudas	4	40	960	9600
Flat fishes	10	100	2400	24000
Others	106	636	25440	152640
Total	407	4376	97680	1050240

Although prawns contributed about 14 per cent of the catch, they realise about 50 per cent of the gross revenue. The average catch per trip works out to 814 kg. realising a gross revenue Rs.4376. The average annual catch of a trawler works out to 97.68 tonnes realising a gross revenue of Rs.10.5 lakhs for 240 fishing trips. With regard to trawlers at Neendakara thread fin-breams and silver bellies are the dominant varieties in the catch (Table VII-19)

Prawns constitute 6 per cent of the catch and 24 per cent of the gross revenue. Cuttle fishes constitute about 4 per cent of the catch and 13 per cent of the revenue. However, it is essential to note that about 76 per cent of the gross revenue of trawlers at Neendakara is from bye catches (miscellaneous catch). The catch per trip works out at 472 kg realising a gross revenue of Rs.4490.

On an average, there are about 236 fishing days per annum for the trawlers operating at Neendakara. The average annual catch of a trawler is about 111.4 tonnes, with gross earning of about Rs.10.58 lakh per annum.

TABLE VII-19

AVERAGE CATCH AND EARNINGS OF A TRAWLER AT NEEDAKARA DURING 1992-93

Variety	Per Trip		Annual	
	Catch Kg.	Revenue Rs.	Catch Kg.	Revenue Rs.
Prawns	27	1080	6372	254880
Cuttle fish	20	600	4720	141600
Rays	8	40	1888	9440
Croakers	26	120	6136	28320
Ribbon fishes	29	130	6844	30680
Carangids	40	320	9440	75520
Silver bellies	80	400	18880	94400
Pomfrets	2	80	472	18880
Thread fin breams	90	600	21240	141600
Other perches	30	300	7080	70800
Barracudas	10	160	2360	37760
Others	110	660	25960	155760
Total	472	4490	111392	1059640

There are reports that the prawn stock all along the kerala coast are being fished intensively and there is practically no scope for increasing the fishing effort any more (Muthu, 1988). The present analysis also indicates that the catch rate of trawlers has considerably declined. The contribution of shrimps in total revenue is hardly 25 per cent both at Calicut and Neendakara. However, a healthy development is that the over-dependence of prawn catches for the sustenance of trawl unit has been drastically reduced as other varieties of fish caught also fetch better prices in the domestic market.

INITIAL INVESTMENT

The average initial investment of a new trawl unit during 1992 ranges from Rs.5.4 lakhs at Calicut to 6 lakhs at Ernakulam (Table VII-20)

The difference in investment between centres is mainly due to the variation in the type of wood used for hull and horse power of engines. The average capital requirement of hull alone ranges from Rs.2.8 lakhs at Calicut to 3.10 lakhs at Ernakulam and an engine ranges from Rs.2.5 lakhs to 2.8 lakhs between selected centres.

The fixed cost consists of the depreciation of fishing equipments which depends on its life expectancy, the interest for initial investment and any other costs which are incurred even if there is no operation. The life expectancy of a new hull and engine is considered as 10 years.

TABLE VII-20

ANNUAL INCOME AND EXPENDITURE STATEMENT OF TRAWLERS AT SELECTED CENTRES IN KERALA DURING 1992-93

Item		Calicut	Ernakulam	Neendakara
I.	Average initial investment Rs.			
	a) Hull	28000	310000	300000
	b) Engine	250000	280000	260000
	c) Gear	10000	10000	10000
	Total	540000	600000	570000
II.	Annual fixed cost Rs.			
	a. Depreciation			
	Hull & Engine (10%)	53000	59000	56000
	Gear (50%)	5000	5000	5000
	b. Interest for investment Rs. (15%)	81000	90000	85500
	Total	139000	154000	146500
III.	Operating costs Rs.			
	a. Labour	134400	245660	201550
	b. Fuel	328050	264000	409224
	c. Jetty rent and Auction charges	32600	42000	43000
	d. Repairing & maintenance	16000	24000	26400
	e. Other expenses	6000	7240	10800
	Total	517050	582900	682950
IV.	Annual Total cost Rs.	656050	736900	829450
V.	Gross revenue Rs.	769824	1050240	1059640
VI.	Net operating income Rs.	252774	467340	376690
VII.	Net Profit Rs.	113774	313340	230190

The interest for initial investment has been worked out at the rate of 15 per cent per annum. The annual fixed cost component of trawlers ranges from Rs.139000 at Calicut to Rs.154000 at Ernakulam.

OPERATING COSTS:

The day-to-day expenses incurred for the working of the unit is termed as variable or operating costs. The expenses on fuel, wages to labour and repairing and maintenance are the major components of operating costs of a mechanised boat. Generally wages are porportional to returns as sharing system is followed in these units. The average annual operating cost of trawlers worked out at Rs.517050/- at Calicut Rs.582900 at Ernakulam and Rs.682950 at Neendakara (Table VII-20)

About 63 per cent of the operating costs of trawlers at Calicut, 45 per cent at Ernakulam and 59 per cent at Neendakara are incurred towards fuel expenses. Similarly labour expenses accounted 26 to 42 percent of the operating expenses of trawlers at the selected centres.

TOTAL COST AND NET INCOME

The total cost per annum (fixed & operating cost) for a trawler works out at Rs.656050 at Calicut Rs.736900 at Ernakulam and Rs.829450 at Neendakara during 1992-93. The operational cost alone constituted 79 to 82 per cent of the total annual cost of trawlers operating along the selected centres of Kerala coast.

Net operating income per annum (income over operating expenses) for trawlers works out to Rs.252774/- at Calicut Rs.467340 at Ernakulam and Rs.376690 Neendakara. The annual net profit is obtained by deducting fixed and variable costs from the gross income of a unit in a year. Net profit realised by the trawlers ranges from Rs.113774 at Calicut and to Rs.3.14 lakhs at Ernakulam during 1992-93.

Only a few studies on the economic viability of trawlers along Kerala coast have been conducted so far (Anon, 1978). These studies indicated that the trawl units along Kerala coast are running on profit. Although the catch rates declined and cost of operation of the boats-increased, better prices for the bye catches led to the success of these units. The present analysis also indicated that the prawn catches contributed substantial revenue only during a few months of the year. It has almost come to a stage that a trawler can survive even without prawn catch.

The study indicates that the gill netters are found to be highly efficient in terms of productivity and profitability even with less number and fishing trips. Gill net fishing by mechanised boats are mainly directed to catch seer fishes. Divesification to catch other quality fishes and introduction of bigger boats with longer operational range will further help to increase the profitability. In view of the enormous fishery resource potentialities in the Wadge Bank and EEZ of Kerala introduction of deep sea vessels especially for gill net fishing should be encouraged.

The costs and earnings of different craft-gear combinations in artisanal, motorised and mechanised sectors in marine fisheries of Kerala has been discussed in this chapter. The average catch and earning per trip and annual income and expenditure statements not only brought out the profitability of various fishing technique of different investment ranges but also this will be helpful to assess the comparative economic efficiency.

CHAPTER VIII

PRODUCTION FUNCTION, ECONOMIC EFFICIENCY AND MANAGEMENT

The catch and income in marine fishing may vary among fishermen due to differences in technology, input combination, fishery resource abundance, and technical efficiency in addition to pure luck (Panayotlu, 1985 & Fredericks, 1985) The production of fish or any crop depends on the employment of various resources generally called inputs or factors of production. In marine fishing, the initial investment on equipments (Craft & gear), labour, fuel and other operational expenditures are the factors of production. The production function describes the rate at which these factors are transformed into products. The production function estimation further yields information on returns to scale for various fishing techniques. To estimate the degree of efficiency of input used, an attempt is made to relate the value of the marginal products of inputs (MVP) to their price (P). The inputs considered for the computation of production function of some of the techniques are fuel, fishing days and repairing and maintenance charge (Panickar & Srinath, 1991)

TRAWLERS AT ERNAKULAM

A Cobb-Douglas type of production function is estimated for trawler operation at Ernakulam and the equation is given below.

$$Y = 6.4763 \; X_1^{0.0891} \; X_2^{0.1301*} \; X_3^{0.7998*} \; X_4^{0.2498}$$

$$(\pm 0.2998) \quad (\pm 0.0499) \quad (\pm 0.2987) \quad (\pm 0.1812)$$

$$R^2 = 77.5\ \%$$

* Significant at 5 % level.

Where Y indicates gross revenue, X1 fuel cost, X2 repairing and ...nance cost, X3 actual fishing trips and X4 other operating costs.

The production elasticities of repairing and maintenance and ...g trips are significant at 5% level, when number of fishing trips ...sed by 1 % from the average level, the output will increase by ...%. Similarly if the repairing and maintenance cost is increased by ... the output will increase by 0.13%. However the production elasticity ...el cost is negative and not significant. It indicates that the fuel ... per trip should be reduced to maximise profit.

The MVP of fishing days for trawlers at Ernakulam is worked ...using.

$$MVPX3 = b3 \frac{\bar{Y}}{\bar{X}3}$$

Where X 3 - fishing days
Y - average annual income and
b3 - the production elasticity

To answer the questions whether the inputs are used to the ...imum level for maximizing profit, the marginal value products (MVP) ...factors compared with their respective acquisition cost. The acquisition ...t per day of operation works out to 2428 as against marginal value ...oduct of Rs.2744 for one fishing day. This indicates that the returns ... be inceased with enchanced number of fishing days.

...TORIZED CATAMARANS WITH HOOKS & LINES

The estimated production function is given below :

	1.2871 *	0.5512*	0.1897
...4313	X_1	X_2	X_3
	(± 0.2743)	(± 0.0796)	(± 0.1512)

R^2 = 71.5 %

* Significant at 5 % level.

Where Y = Average annual revenue per maintenance (Rs)

X1 = Fishing days in a year

X2 = Annual fuel cost

X3 = Annual repair & maintenance charges.

The value of marginal product of one trip works out at Rs.942 whereas the average operating cost per trip is only Rs.258. This indicates that the number of trips per each unit as well as the number of units with hook and line can be increased to optimise the total income as well as profit from the fisheries.

ECONOMIC EFFICIENCY AND MANAGEMENT

To assess the comparative economic efficiency of different type of fishing units, the economic indicators such as rate of returns, returns to labour, capital and fuel efficiency, pay back period, break-even price, etc., have been worked out on the basis of costs and earnings data. The capital turn-over ratio is used to measure the rate at which income is generated by capital investment. Rate of return and pay back period explains the economic feasibility of undertaking a particular investment. The returns to labour and their productivity per trip under various technological options give an idea about the allocative efficiency of labour.

The economic parameters of catamarans operating a single type of gear like anchovies net, sardine gill net, drift gill net and hook and line throughout the year have been worked out and given in Table VIII-1

TABLE VIII-1

KEY ECONOMIC INDICATORS - CATAMARANS WITH SINGLE GEAR AT SELECTED CENTRES OF KERALA DURING 1992-93

Economic Parameters	Anchovies net	Sardine gill net	Drift gill net	Hooks & lines
Average annual fishing trips	240.00	220.00	150.00	220.00
Average catch per trip (Kg)	43.00	24.00	49.00	18.00
Gross revenue per trip (Rs)	320.00	188.00	578.00	372.00
Average operating cost per trip	250.00	34.00	410.00	286.00
Net operating income per trip	70.00	54.00	168.00	86.00
Quantity of fish produced per man day (Kg)	21.50	12.00	16.30	9.00
Value of production per man day	160.00	94.00	192.00	186.00
Wages received per man day	105.00	54.80	112.00	130.00
Operating cost per Kg. of fish	5.80	5.60	8.36	15.88
Average total cost per trip	270.00	158.00	700.00	330.00
Break even price per Kg. of fish	6.26	6.60	14.28	18.32
Average price realized per Kg. of fish	7.40	7.84	11.80	20.66
Capital turn over ratio	6.98	3.18	0.78	5.84
Rate of return on capital (%)	125.00	67.00	-	82.00
Operating cost ratio	0.78	0.70	0.71	0.77
Total cost ratio	0.84	0.84	1.21	0.88
Pay back period (years)	0.72	1.27	-	0.82

Single gear-craft combinations are less capital - intensive and mostly oriented towards labour utilization. Catamarans with drift gill nets (Ozhukuvala) are operating less number of trips per annum among the four selected categories. However, the earning per trip, quantity of fish caught and other parameters indicate the advantage of this combination provided, this unit operate more number of fishing trips. However, the operation of hook and line by catamarans fulfill most of the economic tests to rank first among the least investment group of fishing techniques in the artisanal sector.

Combination of operating three types of gill nets, suiting different seasons of the year by catamarans is highly prevalent along Kerala coast. The key economic indicators for catamaran operating Choodavala, Eachavala and Chemmenvala combination at Poonthura, Chalavala, Ozhukkuvala and Choodavala at Marianad, Chalavala, Eachavala and Choodavala at Eravipuram, and Chalavala, Thattuvala and Chemmenvala at Azheekal have been worked out and given in Table VIII-2

All types of combinations of gill nets by catamaran are found to be economically efficient. However, the catamaran operating Chalavala, Ozhukkuvala and Choodavala at Marianad in the high investment group and Chalavala, Thattuvala and Chemmeenvala at Azheekal in the low investment group have been found comparatively more efficient than the other units. The study further indicates that their earnings can be further increased if they take hook and line also along with other nets.

TABLE VIII-2

KEY ECONOMIC INDICATORS - CATAMARANS OPERATING COMBINATION OF GILL NETS AT DIFFERENT CENTRES

Economic Parameters	Poon-thura	Maria-nad	Eravi-puram	Azhee-kal
Average annual fishing trips	257.00	220.00	232.00	268.00
Average catch per trip (Kg)	30.00	116.00	32.00	42.00
Gross revenue per trip (Rs)	304.00	1112.00	312.00	510.00
Average operating income per Trip	216.00	766.00	216.00	354.00
Net operating income per trip	88.00	346.00	96.00	156.00
Quantity of fish produced per man day	10.00	23.00	11.00	14.00
Value of production per man day	102.00	220.00	108.00	170.00
Wages received per man day	58.00	138.00	64.00	104.00
Operating cost per Kg. of fish	7.20	6.60	6.80	8.40
Average total cost per trip	266.00	952.00	266.00	408.00
Break-even price per Kg. of fish	8.86	8.20	8.30	9.70
Average price realized per Kg.	10.12.	9.58	9.76	12.14
Capital - turn over ratio	2.52	2.72	2.68	4.14
Rate of return on capital	46.40	54.20	54.70	98.30
Operating cost ratio	0.71	0.69	0.70	0.70
Total cost ratio	0.87	0.86	0.85	0.80
Pay back period (years)	1.70	1.40	1.50	0.90

The economic indicators of non-motorised plank-built boats operating shore seines at Chellanam, Sardine gill nets at Quilon, Choodavala at Blangad and Thallumadi at Anjengo are given in Table VIII-3

TABLE VIII-3

KEY ECONOMIC INDICATORS - PLANK BUILT BOATS OPERATING DIFFERENT GEARS AT SELECTED CENTRES DURING 1992-93

Economic parameters	Shore Seine (Chellanam)	Sardine gillnet (Quilon)	Chooda vala (Blangad)	Thallu-madi (Anjengo)
Average annual fishing trips	180.00	240.00	210.00	265.00
Average catch per trip (Kg)	110.00	79.00	64.00	10.00
Gross revenue per trip (Rs)	1212.00	520.00	730.00	290.00
Average operating cost per trips (Rs)	864.00	368.00	482.00	206.00
Net operating income per trip (Rs.)	348.00	152.00	248.00	84.00
Quantity of fish produced per man day (Kg)	3.67	16.00	11.00	2.50
Value of production per man day (Rs.)	40.40	105.30	125.40	72.50
Wages received per man day (Rs)	27.00	60.86	67.80	42.16
Operating cost per Kg of fish (Rs)	7.84	4.66	7.44	20.60
Average total cost per trip	1114.00	466.00	692.00	264.00
Break-even price per Kg of fish (Rs)	9.20	5.90	10.80	26.30
Average price realised per Kg of fish	11.00	6.58	11.40	29.00
Capital turn-over ratio	2.87	2.08	1.22	1.92
Rate of return on capital (%)	62.00	37.00	21.00	33.00
Operating cost ratio	0.71	0.70	0.66	0.70
Total cost ratio	0.83	0.90	0.94	0.91
Pay back period (Years)	1.50	2.20	3.80	2.40

The shore seine operation is slowly disappearing along Kerala coast. The economic efficiency measures of these units operating at Chellanam indicate that they are viable except satisfactory returns to labour. Although these units earn about Rs.348 as net operating income per trip the labourers receive hardly Rs.27.00. Hence, this can be encouraged as a part time avocation for the fishermen at suitable centres.

Plank-built boats operating Thallumadi is showing an increasing trend along Kerala coast. Although the average catch per trip is 10 per Kg., they earn a gross revenue of Rs.490 per trip as these units are directed to catch high priced prawns along the near shore areas. These units are economically viable and provides lot of employment to the fishermen of Trivandrum regions. But it is feared that more than 30 percent of its catches comprise juvenile prawns which do not appear to be a good trend for the shrimp fishing of this region in the long run.

The capital-turn over ratio (1.22) rate of return on capital (21%) and average annual fishing days (210) are comparatively less for the Choodavala units at Blangad. For better production and optimum profitability these units should be encouraged for motorisation.

Motorised catamarans operating Gillnet at Marianad Vattavala at Neendakara and motorised P.B. boats operating sardine gill net at Puduvaippu and Thattumadi at Madapalli show better economic efficiency (Table VIII-4). The investment involved in these units are comparatively higher due to motorisation. But the net operating income per day, average annual fishing trips and wages received by a labourer are far

TABLE VIII-4

KEY ECONOMIC INDICATORS - MOTORISED UNITS AT SELECTED CENTRES DURING 1992-93

Economic Parameters	Catamarans		P.B. Boats	
	Shore seine (Marianad)	Vattavala (Neendakara)	Sardine gillnet (Puduvaippu)	Choodvala (Madapalli)
Average annual fishing trips	243.00	195.00	260.00	220.00
Average catch per trip (Kg)	30.00	78.00	111.00	96.00
Average revenue per trip (Rs)	630.00	1036.00	724.00	1378.00
Average value realised per Kg of fish	21.00	13.28	6.52	14.34
Quantity of fish produced per man day	80.00	39.00	44.40	38.40
Value of production per man day (Rs)	210.00	260.00	144.00	276.00
Average remuneration received by a labourer per day (Rs)	59.00	69.00	41.00	77.00
Quantity of fish produced per litre of fuel (Kg.)	4.30	8.70	15.80	6.90
Average fuel cost per trip (Rs.)	70.00	90.00	70.00	140.00
Fuel cost per Kg of fish (Rs)	2.34	1.16	0.62	1.46
Average operating cost per trip (Rs)	458.00	726.00	566.00	1018.00
Operating cost per Kg. of fish (Rs)	15.26	9.30	5.10	10.60
Average total cost per trip (Rs)	558.00	1016.00	720.00	1326.00
Break even price per Kg. of fish	18.60	13.02	6.48	13.80
Capital turn over ratio	3.00	1.36	2.00	1.68
Rate of return on capital (percent)	49.00	18.00	16.00	22.00
Pay back period (Years)	1.50	3.90	3.50	3.50
Operating cost ratio	0.72	0.70	0.78	0.73
Total cost ratio	0.88	0.98	0.99	0.96
Average net operating income per day	132.00	310.00	158.00	304.00

higher than the non-motorised units operating same type of gears. The results further indicate that the Thattumadi operation by motorised catamarans and P.B. boats earn more profit in the motorised sector. The earnings of these units can be further increased by enhancing the average annual fishing days if some other gears are supplemented to operate in the lean season.

The key economic indicators for trawlers operating at Calicut, Ernakulam, and Neendakara are estimated and given in Table VIII-5.

The operation of trawlers during April 1992 - March 1993 are ighly profitable in all the selected centres. The annual fishing trips anges from 236 at Neendakara to 243 at Calicut. The quantity of fish roduced per manday ranges from 43 Kg. at Calicut to 79 Kg at leendakara. Average remuneration received per day, ranges from Rs.92 t Calicut to Rs.170 at Ernakulam. Quantity of fish produced per litre f fuel varies from 1.9 Kg. at Calicut to 3.7 Kg at Ernakulam.

Average fuel cost per trip varies from Rs.1100 to 1700 between different centres. The fuel cost per kg. of fish production in trawlers works out at Rs.2.70 at Ernakulam Rs.3.60 at Neendakara and Rs.5.26 at Calicut. The break-even price per Kg. of fish works out at Rs.9.92 at Calicut Rs.7.54 at Ernakulam and Rs.7.44 at Neendakara as against the actual price of Rs.12.32 Rs.10.76 and Rs.9.52 respectively. The capital turn-over ratio, rate of return to capital and pay back period for the trawlers operating at different centres also show high economic returns.

TABLE VIII-5

KEY INDICATORS OF ECONOMIC EFFICIENCY - TRAWLERS AT DIFFERENT CENTRES DURING 1992-93

Item	Calicut	Ernakulam	Neendakara
Average annual fishing trips	243.00	240.00	236.00
Average catch per trip (Kg)	257.00	407.00	472.00
Average revenue pertrip (Rs)	3168.00	4376.00	4490.00
Average value realized per Kg of fish	12.32	10.76	9.52
Quantity of fish produced per man day	42.83	67.83	78.67
Value of production per man day (Kg)	528.00	730.00	750.00
Average remuneration received by a labourer per day (Rs)	92.00	170.00	142.00
Quantity of fish produced per litre of fuel (Kg)	1.90	3.70	2.80
Average fuel cost per operation	1350.00	1100.00	1700.00
Fuel cost per Kg. of fish (Rs)	5.26	2.70	3.60
Average operating cost per day of operation (Rs)	2128.00	2428.00	2894.00
Operating cost per kg of fish (Rs)	8.28	5.96	6.12
Average total cost per day of operation	2552.00	3070.00	3514.00
Break even price per Kg. of fish (Rs)	9.92	7.54	7.44
Capital turn over ratio	1.43	1.75	1.86
Rate of return on capital (Percent)	36.00	67.00	55.00
Pay back period (Years)	3.14	1.60	2.00
Operating cost ratio	0.67	0.56	0.64
Total cost ratio	0.85	0.70	0.78
Average net operating income per day	1040.00	1948.00	1496.00

The present study confirms that the catch rates of prawns have declined, but the profitability has not shown any alarming scale of reduction.

Gill net operation by mechanised boats at Kannamali and Sakthikulangara centres have been studied and the estimated key economic indicators are given in Table VIII-6.

The average annual fishing trips vary from 167 to 180. The cost of production per kg. of fish worked out at Rs.14.64 at Kannamali and Rs.18.40 at Sakthikulangara against the market price of Rs.21.46 and Rs.25.84 respectively. The average remuneration received per trip per crew ranges from Rs.252 at Sakthikulangara to Rs.382 at Kannamali. The average fuel cost per trip of operation is Rs.1100 at sakthikulangar as against Rs.1320 at Kannamali. The quantity of fish produced per litre of fuel varies from 1.93 to 2.7 Kg. The fuel cost per Kg. of fish production works out at Rs.3.74 at Kannamali and Rs.5.18 at Sakthikulangara. The other economic parameters like capital turnover ratio, rate of return on capital, pay back period and net operating income also indicate that the operation of gill nets by mechanised boats along Kerala coast are highly profitable.

During the seventies and early eighties many fishermen shifted to trawl operations due to lucrative shrimp catches and less profitability of gillnetters (Panickar et al., 1990). Now the quality fishes caught in gillnetters also receive good prices in the internal market and the profitability of these units increased substantially. The presnt study clearly indicates that the operation of gillnetters are more profitable than the trawlers along Kerala coast.

TABLE VIII-6

KEY INDICATORS OF ECONOMIC EFFICIENCY - GILLNETTERS AT KANNAMALI AND SAKTHIKULANGARA DURING 1992-93

Item	Kannamali	Sakthikulangara
Average annual fishing trips	167.00	180.00
Average catch per trip (Kg.)	353.00	212.00
Average revenue per trip (Rs)	7576.00	5476.00
Average value realized per Kg. of fish	21.46	25.84
Quantity of fish produced per man day	70.60	42.40
Value of production per man trip (Rs)	1516.00	1096.00
Average remuneration received by a labourer per trip (Rs.)	382.00	252.00
Quantity of fish produced per litre of fuel (Kg.)	2.70	1.93
Average fuel cost per trip of operation (Rs)	1320.00	1100.00
Fuel cost per Kg. of fish (Rs.)	3.74	5.18
Average operating cost per operation	3906.00	2842.00
Operating cost per Kg. of fish (Rs.)	11.00	13.40
Average total cost per operation (Rs.)	5170.00	3898.00
Break-even price per Kg. (Rs.)	14.64	18.40
Capital turn over ratio	1.80	1.50
Rate of return on capital (Percent)	72.00	59.00
Pay back period (Years)	1.40	1.70
Operating cost ratio	0.52	0.52
Total cost ratio	0.68	0.71
Average net operating income per trip	2670.00	2634.00

The production function analysis indicates that the fishing effort can be increased in the motorized and mechanised sectors. For these units enhancing the number of fishing trips with extended operation in deeper areas leaving the near shore zone to the artisanal sector is advisable. With regard to comparative economic efficiency - the hook and line units in artisanal sector, operation of drift gill nets as well as hook and line in motorised sector and gillnetters in the mechanised sector are found to be more efficient than other options.

CHAPTER IX

MARINE FISH MARKETING, PRICE STRUCTURE AND PROFIT MARGINS

Marine fishermen in India are said to have suffered from not getting the due price for their produce. The difference between the price of fish paid by the consumer and received by the fishermen is considered to be large. The general hypothesis is that conditions of monopsony and oligopsony characterise the fish marketing structure of India at the various stages and as a result fishermen do not get the advantage of high price prevalent at consumer markets. Basic econoomic theory indicates that in a perfectly competitive market no factor of production earns more than its opportunity cost and pure profit cannot exist in the long run because it is eliminated through competition. If a market is dominated by a single buyer it can be termed as monopsony, buyers monopoly with two buyers as duopsony, more than two, but not too many as oligopsony and so on. Fish marketing in most of the developing countries are facing monopsony, Oligopsony and monopsonistic competition. (Fernando, 1985) Under conditions of imperfect competition, which include monopsony, oligopsony and monopsonistic competition, pure profit is expected to be positive in long-run equilibrium and it cannot be explained wholly in terms of the opportunity costs of the services provided by the middlemen.

Fish marketing system may be defined as all those functions and activities involved from the point of catching of fish to the point of final consumption. The pricing efficiency is concerned with improving the operation of buying, selling and other connected aspects of marketing process so that it will remain responsive to consumer behaviour (Chhotan Singh and vasisht, 1985 and Surya Prakash 1979).

DOMESTIC AND EXPORT MARKETING :

More than 80 percent of the marine fish landings of Kerala is supplied in the internal markets. Fish Market Centres of Kerala are marked in Fig IX-1. Prior to independence substantial quantity of dry fish was exported from the Kerala especially from Cochin. With the advent of processing techniques like freezing and storage coupled with tremendous demand for prawns in several European countries, the export marketing of marine fish recorded phenomenal growth in recent years. Ice plant, cold storage and canning centres of Kerala are marked in Fig IX-2.

Frozen prawns earned substantial foreign exchange in marine fish exports and paved the way for the growth of an organised sea food export industry. (Saxena, 1973). Product diversification and value added product concept in the export front has also been initiated to sustain the growth rate in the export front. Now, not only shrimps but also cuttle fish, shark-fins, crabs, seer fish sea cucumber etc., are also exported substantially. In the recent days lobstors, crabs, groupers etc., are exported alive. The economy of subsidiary industry of the marine fishery sector of the state, to a larger extent is highly depending on the demand of our marine products in the external markets. However, the development in the internal marketing system is rather slow. The parallel development of the domestic marketing system is also essential to sustain healthy development of marine fisheries sector in the long run. It must be remembered that apart from earning foreign exchange, exports were singularly responsible for increasing the earnings of the fishermen. At present the economics of operation of trawlers almost entirely depends on the price, the producer gets for prawns which in turn depends on the

Fig IX-1

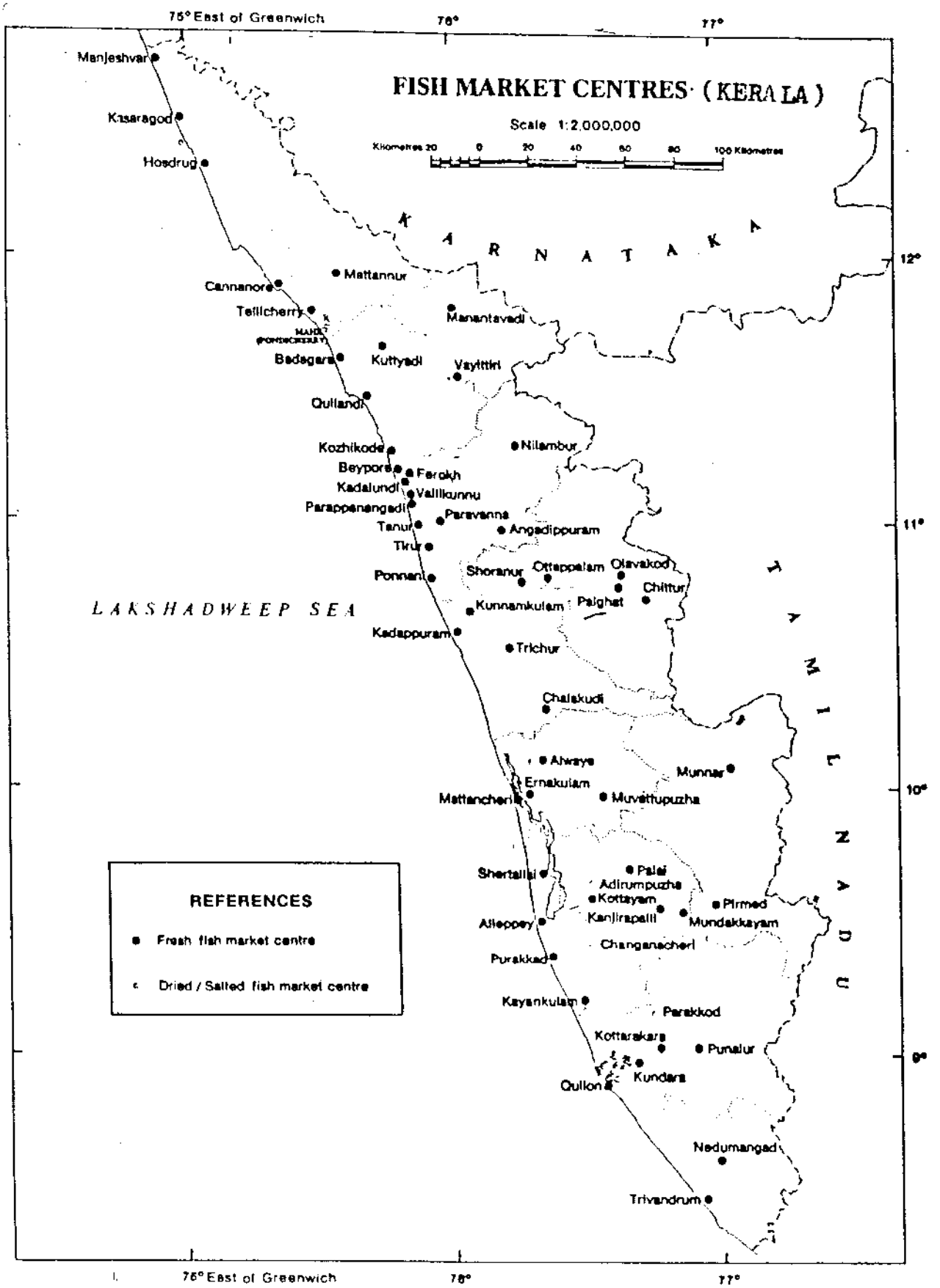
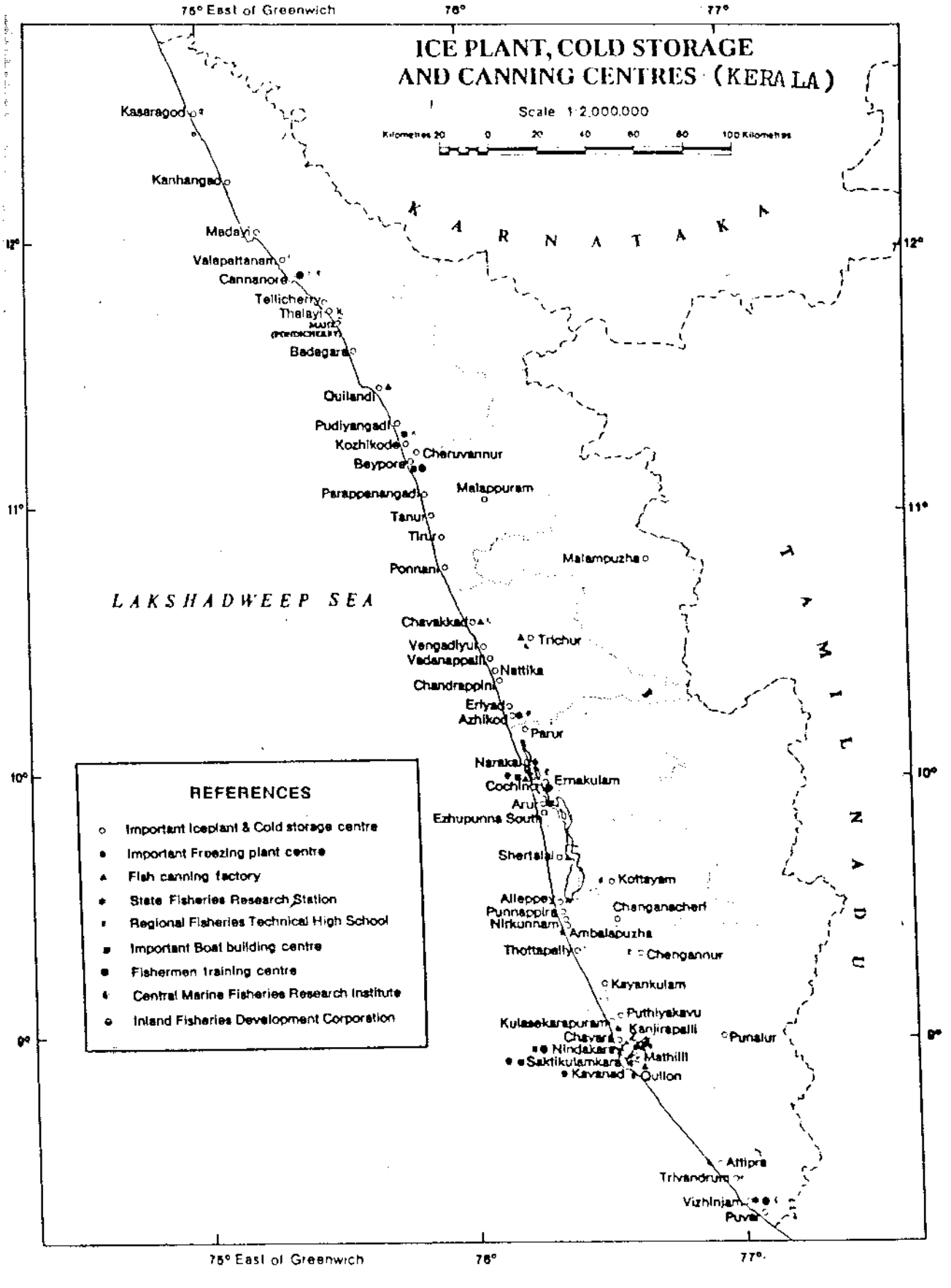

FISH MARKET CENTRES (KERALA)
Scale 1:2,000,000
Kilometres 20 0 20 40 60 80 100 Kilometres
75° East of Greenwich
76°
77°
12°
11°
10°
9°
KARNATAKA
TAMILNADU
LAKSHADWEEP SEA
Manjeshvar
Kasaragod
Hosdrug
Mattannur
Cannanore
Tellicherry
Mananthavadi
Badagara
Kuttyadi
Vayittiri
Quilandi
Kozhikode
Nilambur
Beypore
Farokh
Kadalundi
Vallikunnu
Parappanangadi
Paravanna
Tanur
Angadippuram
Tirur
Shoranur
Ottappalam
Olavakod
Ponnani
Chittur
Kunnamkulam
Palghat
Kadappuram
Trichur
Chalakudi
Munnar
Ernakulam
Mattancheri
Muvattupuzha
Shertallai
Palai
Adirumpuzha
Kottayam
Pirmed
Kanjirapalli
Alleppey
Mundakkayam
Changanacherl
Purakkad
Kayankulam
Parakkod
Kottarakara
Punalur
Kundara
Quilon
Nedumangad
Trivandrum
REFERENCES
Fresh fish market centre
Dried / Salted fish market centre

Fig IX-2


ICE PLANT, COLD STORAGE
AND CANNING CENTRES (KERALA)
Scale 1:2,000,000
Kilometres 20 0 20 40 60 80 100 Kilometres
75° East of Greenwich
76°
77°
12°
11°
10°
9°
KARNATAKA
TAMILNADU
LAKSHADWEEP SEA
Kasaragod
Kanhangad
Madayi
Valapattanam
Cannanore
Tellicherry
Thalayi
Badagara
Quilandi
Pudiyangadi
Kozhikode
Cheruvannur
Beypore
Parappanangadi
Malappuram
Tanur
Tirur
Ponnani
Chavakkad
Trichur
Vengadiyur
Vadanappalli
Nattika
Chandrappini
Erhyad
Azhikod
Parur
Narakal
Ernakulam
Cochin
Aroor
Ezhupunna South
Shertalai
Kottayam
Alleppey
Punnapra
Nirkunnam
Changanacheri
Ambalapuzha
Thottapally
Chengannur
Kayankulam
Puthiyakavu
Kulasekarapuram
Kanjirapalli
Chavara
Punalur
Nindakara
Mathilil
Sakthikulamkara
Kavanad
Quilon
Attipra
Trivandrum
Vizhinjam
Puvar
REFERENCES
Important Iceplant & Cold storage centre
Important Freezing plant centre
Fish canning factory
State Fisheries Research Station
Regional Fisheries Technical High School
Important Boat building centre
Fishermen training centre
Central Marine Fisheries Research Institute
Inland Fisheries Development Corporation

international market. Though such complete dependence on the foreign market is not desirable, it is inevitable till the products obtain a sufficiently high demand in internal market.

EFFICIENCY OF FISH MARKETING SYSTEM

The marketing margin is an indicator of efficiency of the marketing system. In the absence of any value added process, higher the value of marketing margin the lower is the effiiciency of the marketing system. (Huger and Hirenath, 1984) On the one hand, the producers deserve a legitimate share in the consumer's rupee, and on the other, the consumers have to be safeguarded against excessive prices. These twin objectives can be achieved by ensuring various marketing services at reasonable cost i.e., restricting margins to a reasonable level. As fish like any other product moves closer and closer to the ultimate consumer, the selling price increases since the margins of the various intermediaries and functionaries are added to it. The perishable nature of the fish, seasonality of its production and the distance between the producer and the consumer are some of the important factors which require attention while assessing the marketing margin. (Swarup et al., 1985).

MARKETING STRUCTURE

All the marine fish landing centres of the State spreading the entire costal belt serve as primary markets. However, the major primary fish markets of Kerala coast are Vizhinjam, Neendakara Cochin, Calicut Cannanore and Kasaragode where the fish arrivals are comparatively higher

due to mechanised landings. The mode of sales is by auctioning. The mechanised gillnetters and indigenous fishing units mostly land their catches in the morning and most of the trawlers land their catch in the afternoon. The morning session of sales in primary markets is from 6 AM to 10 AM and evening market commences from 14.30 hours and continues till late evening.

There are several wholesale markets in the state located both near the coast and interior hinterlands. Some of the important wholesale markets of Cochin city are Fort Cochin, Munambam and Manasery. In Calicut District, Quilandi and Beypore are the major whole sale centres of marine fish. Either the wholesalers are directly bringing the fish from the primary markets or getting supplies from the commission agents. The tempo van carries 600 to 800 kg of fish packed in plastic tray. (Plate IX-1).

e fish in the tray loaded for transportation are properly iced and cked to avoid spoilage.

The final phase in the supply line of marine fish is the umerable retail markets located in the nook and corner of the State. e retailers collecting the fish either from the primary market or the olesale market use mostly bicycles or auto rickshaws (Plate IX-2) as eir mode of transportation. There are many wholesalers supply fish rectly to the retailing centres.

RKET CHANNELS

Since the marine fish is consumed all over the country, it has be carried to a long way from coastal to interior parts of the country. rine fishes thus pass through the following prominent channels to reach ultimate consumers

Fishermen-Auctioneer-Agents of freezing plants-Exporter -Retailer-consumer

Fishermen-Auctioneer-Processors (Dry fish)-wholesaler - Retailer-consumer

Fishermen-Auctioneer-Wholesaler (Primary market)-wholesaler (retail markets) - Retailers - consumers

Fishermen-Auctioneer-Commission agents - Wholesaler - Retailer - consumer

Fishermen-Auctioneer-Retailer - Consumer

Fishermen-Auctioneer - consumer

The major portion of fish trading in internal marketing is practised through 3rd 4th and 5th channels. The auctioneers in the primary market and comission agents in secondary markets are also involved in the process without involving themselves in direct possession of the fish.

AUCTION SALE

The prevalent practice of disposal of fish of large volumes is through auction where buyers participate in bidding. Normally auction is carried out after sorting of the catch (Plate IX-3). The open bidding is done simply by verbally declaring the bids of all the perspective buyers for a particular fish lot. As a rule, fish lots are awarded to the highest bidder.

In general each fishing boat operator directs his catch to a particular auctioneer regularly. As producer's representative, the auctioneers perform the selling function for which they are paid a commission of about 5 per cent of the gross sales. Because fish is generally sold on credit, the auctineer sometimes makes payments by himself to the suppliers promptly and fully to maintain their goodwill and confidence.

As producer's representative the auctioneers are free to negotiate with any buyer. Generally, the auctioneers sell their products on credit payable before the next purchase. In these cases the credit-worthiness of the buyer is the most important factor, considered by auctioneers. There are also transactions that involve cash and instalment payments.

MARKETING EXPENSES

The fish passes through a number of hands before reaching to the ultimate consumer. Due to its perishable nature proper preservation and handling is vital. Bamboo baskets are mostly used to pack the fish which is costing around Rs.30 and last for a period of about a month (Plate IX-4). About 25 to 30 Kg of fish can be packed in a single basket. The usual mode of transportation are trucks, tempos, motorized cycle rickshaws, bicycles and head loads. During 1992-93 the freight charge for a truck load was Rs.6 per Kilometer. In the Cochin region, especially for the transportation of fish from Cochin Fishing Harbour wholesale market (Ettumanoor and Perumbavoor) and retail markets, (Kadavanthra, Threvara) the tempo vans and Auto rickshaws are commonly used. At times even 2 to 3 retailers join together and transport their baskets in a single van. For packing on basket of fish 10 to 15 kg of ice is used costing around Rs.10 to 15. The labour charges for packing and loading/unloading works out to Rs.5 per basket.

It was found that the marketing cost including handling and transportation of big size fishes like seer fish, giant sea perch, sharks and barracudas was comparatively higher than that of small size fishes such as sardines, lizard fish and thread fin breams.

DISTRIBUTION PATTERN

The distribution pattern of marine fish in Kerala towards exports, fresh sales in domestic market and for dry edible as well as fish meal for selected years has been given in Tab. IX-1.

TABLE IX-1

DISTRIBUTION PATTERN OF MARINE FISH, KERALA

Distribution pattern	Years 1979	1996	1990	1992
Fresh Domestic (Percent)	50	52	60	62
Dry edible "	37	34	22	19
Dry fish meal "	7	8	10	10
Exports "	6	6	8	9

The present analysis indicates that the supply of fresh domestic fish in internal marketing has increased to 62 per cent in 1992 from about 60 per cent in 1990, 52 per cent in 1985 and 50 percent in 1979. Similarly the supplies for exports and fish meal also shown improvement over the years. Utilization of ice for preservation has been widely accepted among the consumers and fish moves even interior and far off places from the sea shore with out much spoilage.

PRICE BEHAVIOUR

The price behaviour of fish is mainly characterised by wide fluctuations at all stages of transactions in the marketing chain, which resulted from the highly perishable nature of fish and the high variation in its short run supply. Price is determined by the interaction of demand and supply at both producing centres (Primary markets) and consumer markets. At landing centres the market demand is the aggregate demand from wholesalers which is indicated by the number of trucks arriving at the centre and also from cycle vendors, retailers and individual purchasers. There will not be much variation in the day to day volume of transactions by these purchasers or in other words, the short run

demand is more or less stable. However, the level of supply on any day is completely unpredictable and short run supply is highly inelastic. Hence on any day, a bumper catch at a landing centre will slash down the fish prices and a small catch will boost the prices to very high levels. Though the short term fluctuation in fish price is very wide the average annual prices of all commercially important fishes in Kerala during the last decade shows an increasing trend.

The increase in price of marine fish over the years has been substantial. This increase is much higher than all other food articles. The wholesale price of some selected varieties of fish in Kerala for the years 1973-74, 1984-85, 1989-90 and 92-93 is given in Table IX-2.

TABLE IX-2

WHOLESALE PRICE BEHAVIOUR OF SELECTED VARIETIES OF MARINE FISH IN KERALA

NAME	Average Price (Rs/Kg)			
	1973-74*	1984-85*	1989-90*	1992-93**
Silver bellies	2.50	3.00	4.20	6.30
White baits	2.00	5.00	5.85	8.80
Ribbon fish	2.00	5.00	6.15	9.20
Rays	1.00	6.00	6.40	9.60
Sardines	1.00	4.00	6.90	10.35
Mackerel	2.00	6.25	9.00	13.50
Cat fish	1.00	7.75	13.00	19.50
Tuna	2.00	10.00	13.45	20.20
Sharks	1.50	11.25	13.85	20.80
Barracudas	2.00	11.25	15.20	22.80
Pomfrets	5.00	17.50	23.15	34.75
Rainbow runner	3.50	11.00	24.60	36.90
Seer fish	4.00	19.00	28.90	43.35

Source: * Sathiadhas and Panickar, 1988

** Present study

It is interesting to note that the wholesale price of seer fish increased from Rs.4 per kg. during 1973-74 to Rs.43.35 during 1992-93 pomfrets from Rs.5 to 34.75 sharks from Rs.1.50 to 20.80 cat fish from Rs.1 to 19.50 sardines from Rs.1 to 10.35 rays from Rs.1 to 9.60 and so on.

The average retail sales price of selected varieties of marine fish during 1973-74, 1984-85, 1989-90 and 1992-93 is given in Table IX-3. The increase in price over the period of 20 years ranges from 97% to 1260%.

TABLE IX-3

RETAIL SALES PRICE BEHAVIOUR OF SELECTED VARIETIES OF MARINE FISH IN KERALA

NAME	Average retail price (Rs/Kg) 1973-74 *	1984-85 *	1989-90 *	1992-93 **	Increase in price from 1973-1993 as %
Silver bellies	3.50	6.00	6.25	9.40	97
White baits	3.00	8.00	9.00	13.50	450
Ribbon fish	2.50	8.50	10.00	15.00	600
Sardines	3.00	9.85	13.50	18.75	625
Rays	2.00	10.00	10.75	16.15	812
Mackerel	3.00	9.85	12.50	18.75	625
Cat fish	2.50	11.00	16.50	24.75	990
Sharks	2.50	17.00	17.00	25.50	1020
Tuna	3.00	16.50	18.50	27.75	925
Barracudas	2.50	15.35	21.00	31.50	1260
Pomfrets	9.00	22.80	29.50	44.25	491
Rainbow runner	5.00	12.00	31.25	46.90	938
Seer fish	9.00	27.00	35.50	53.25	591

* - region / sources Sathiadhas and Panikkar 1988 and Sathiadhas 1992

** - Present study

The retail price of seer fish increased from Rs.9 per kg during 1973-74 to Rs.53-75 during 1992-93. Similarly all varieties recorded phenomenal increase in the retail prices over the years as shown in the Table.* The rate of increase from 1990 to 93 is much greater than earlier years.

There is considerable seasonal variation in the average primary, wholesale and retail prices of marine fish. The average seasonal prices of different varieties of fish during 1992-93 has been worked out on the basis of data collected from selected landing centres, wholesale market, at Cochin Fisheries Harbour and retail markets of Cochin, Ernakulam main market, Kadavanthra & Thevara of Ernakulam District of Kerala. All the varieties of fish covered under the study were divided into three group based on the level of consumer preference. The consumer preference for a variety was determined by the annual average consumer price of that variety in the selected consumer markets. The fishes with annual average consumer price of above Rs.30 form first group, Rs.15.00 to 30.00 second group and less than Rs.15.00 third group in the present analysis.

The average prices for different varieties of fish at landing centres (Average price of 5 selected landing centres such as Vzhinjam, Neendakara, Cochin, Parappanangodi and Putheangadi) wholesale market (Perumbavoor, Ettumanoor etc.,) and the selected retail markets (Kadavanthara, Thevara during April 1992 - May 1993 are given in Table IX-4.

The fishermen received maximum price for seer fish (Rs.42.00 per kg) and minimum for silver bellies (Rs.4.50 per kg). Barring few varieties like seer fish, sharks etc., the price of many varieties are found to

* IX-3

be more than double of the landing centre price. Among the consumer markets studied, the average retail prices of different varieties of fish were comparatively lower at Thevara market of channel II and higher at Ernakulam main retail market of channel I.

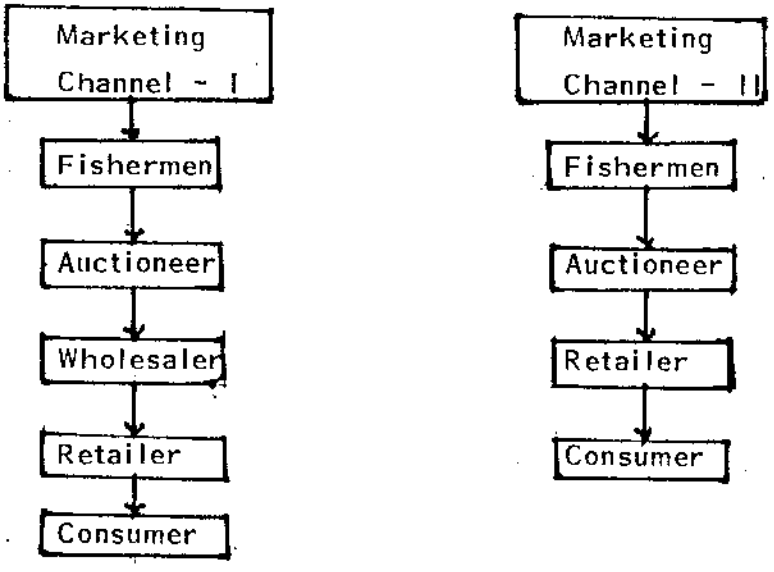


TABLE IX - 4

AVERAGE FISH PRICES AT PRIMARY, WHOLESALE AND RETAIL MARKETS IN COCHIN REGION, KERALA DURING APRIL 1992 - MARCH 1993

VARIETY	LP	Channel-I* WP	RP1	Channel-II** RP2	RP3
Group - I					
Seer fish (Neymeen)	42.00	51.00	67.50	60.00	61.50
Rainbow runner (Kozuvai)	28.50	36.00	51.00	43.50	46.50
Poomfrets (Avoli/Machan)	32.00	37.00	47.50	42.00	45.00
Pig-face breams(Velameen)	19.50	24.00	46.50	39.00	40.50
Redsnapper (Mazhuvan/ Chempalli)	18.00	22.50	31.50	36.00	34.50
Barracudas (oozhi, Oozha)	18.00	21.00	30.00	30.00	31.50

VARIETY	Channel-I*			Channel-II**	
	LP	WP	RP1	RP2	RP3
Group - II					
Reef cod (Kalava)	16.50	21.00	28.50	30.00	34.50
Tuna (Choora)	16.70	22.35	30.45	17.60	30.20
Sharks (Sravu)	18.45	22.65	34.00	29.25	26.10
Cat fish (Koori/Aetta)	14.40	19.95	21.90	26.60	26.40
Wolf herring (Mullavalai/ thoppivalai)	12.50	16.70	24.20	20.40	22.35
Mackerel (Ayila/Kanakeluthi/ Kozhichala)	13.90	16.50	25.90	23.25	24.15
Scads	9.15	12.60	22.30	20.00	22.20
Group - III					
Goat fish (Nakara/ Kilivarnadu)	7.95	11.50	19.50	21.75	22.70
Ribbon fish (Vaala/Chunnambu valla)	7.50	10.50	21.00	17.00	18.00
Thread Fin breams(Kilimeen)	9.00	11.00	15.00	16.95	18.00
Rays (Thirandi)	7.00	10.35	21.30	15.40	17.60
Lizard Fish (Thumbili/ Aranameen)	6.00	9.00	12.00	15.00	16.65
Indian pellena (Kuttha)	7.80	11.10	17.40	15.90	17.50
Gold tripped sardine (salai/Mathakondai)	10.95	15.00	23.00	19.50	19.50
White baits (Netholi/Kozhuva)	8.60	13.20	22.00	17.70	19.00
Silver bellies (Mullan)	4.50	7.50	12.60	9.75	10.20

* Channel I - Fishermen - AUctioner - Commission agents - Wholesaler - Retailer - Consumer

** Channel II- Fishermen - Auctioner - Retailer Consumer.

*** With in the bracket is the local name of the fish.

LP - Landing Centre Price

WP - Whole sale Price

RP - Retail Price

The average, primary, wholesale and retail prices of fish during July-September 1992 are given in Table IX-5.

Fishermen received maximum price for seer fish in group-I sharks in group-II and rays in grroup-III. Comparatively higher retail prices were observed at Ernakulam market. The prices of almost all varieties have shown a declining trend comparing to the previous season.

TABLE IX-5

AVERAGE PRICES AT PRIMARY, WHOLESALE AND RETAIL MARKETS IN COCHIN REGION DURING JULY - SEPTEMBER 1992

VARIETY	Channel-I			Channel-II	
	LP	WP	RP1	RP2	RP3
Group I					
1. Seer fish	35.55	42.60	55.30	51.60	53.25
2. Rainbow runner	28.50	36.00	49.50	42.00	43.50
3. Pomfrets	30.00	37.50	46.50	43.50	43.50
4. Pig-face breams	18.00	24.00	36.00	31.50	33.00
5. Red snapper	13.50	18.00	27.00	28.50	31.50
6. Barracudas	16.50	22.50	33.00	28.50	31.50
Group II					
1. Reef cod	12.00	18.00	25.50	27.00	30.00
2. Tuna	12.60	18.30	24.60	25.90	26.25
3. Sharks	15.60	19.40	27.10	22.60	22.40
4. Cat fish	13.65	20.00	26.50	24.75	23.70
5. Wolf herring	9.45	12.45	17.55	15.75	16.65
6. Mackerel	9.90	11.40	17.20	14.85	14.85
7. Scads	5.20	8.60	15.45	16.10	19.50
Group III					
1. Goat fish	4.80	7.10	12.20	10.10	13.30
2. Ribbon fish	6.00	9.00	15.00	12.75	14.80
3. Thread fin breams	5.60	8.20	13.30	10.95	13.90
4. Rays	6.45	9.50	16.00	12.25	13.50
5. Lizard fish	3.35	5.80	7.60	6.60	7.75
6. Indian pellona	4.50	7.60	13.70	11.55	14.10
7. Gold stripped sardine	5.30	8.40	15.40	12.40	11.40
8. White baits	4.05	6.70	13.50	10.60	11.30
9. Silver bellies	3.00	4.60	9.50	8.10	8.40

Fishermen received an average of Rs.32.40 per kg for seer fish and Rs.2.00 per kg. for lizard fish during October-December 1989 (Table IX-6).

TABLE IX-6

AVERAGE FISH PRICES AT PRIMARY, WHOLE SALE AND RETAIL MARKETS IN COCHIN REGION DURING OCTOBER - DECEMBER 1992

VARIETY	Channel-I			Channel-ii	
	LP	WP	RP1	RP2	Rp3
Group I					
Seer fish	32.40	39.15	46.20	42.45	43.90
Rainbow runner	28.50	34.50	46.50	39.00	42.00
Pomfrets	27.00	31.50	45.00	40.50	40.50
Pig-face breams	13.50	19.50	30.00	25.50	28.50
Red snapper	10.50	16.50	32.50	24.00	25.50
Barracudas	13.50	18.00	30.00	24.00	25.50
Group II					
Reef cod	10.50	15.00	22.50	22.50	24.00
Tuna	13.00	17.00	23.85	21.60	23.25
Shark	16.30	20.80	26.20	21.90	20.85
Cat fish	10.35	16.50	24.75	21.75	19.80
Wolf herring	7.05	10.00	14.85	12.40	13.30
Mackerel	8.70	10.80	18.00	15.25	15.75
Scads	9.90	11.40	15.45	16.10	19.50
Group III					
Goat fish	4.90	7.90	13.05	10.90	13.30
Ribbon fish	6.25	8.80	14.80	12.60	16.75
Thread fin breams	3.80	5.50	8.20	7.10	10.00
Rays	6.70	9.30	16.60	15.60	17.10
Lizard fish	2.00	3.50	6.75	5.80	7.90
Indian pellona	6.50	9.35	15.00	13.20	13.35
Gold stripped sardine	5.55	7.60	11.25	9.70	10.10
White baits	4.50	6.90	9.35	8.25	8.85
Silver bellies	3.00	4.60	9.50	8.10	8.40

In general, the landing, wholesale and retail prices were lowest during the above quarter. The heavy fish landings in the peak season was responsible for the fall in prices. During January-March 1993 the fishermen received the maximum price of Rs.37.00 per kg. for pomfrets and minimum of Rs.4.60 per kg. for silver belliess (Table IX-7).

The lean season associated with lesser supply of marine fish boosted the primary and retail price during this quarter.

TABLE IX-7

AVERAGE PRICES AT PRIMARY, WHOLESALE AND RETAIL MARKETS IN COCHIN REGION DURING JANUARY - mARCH 1993

VARIETY	Channel-I			Channel-II	
	LP	WP	RP1	RP2	RP3
Group I					
Seer fish	36.60	44.30	67.50	52.50	58.50
Rainbow runner	36.00	42.00	57.00	51.00	52.50
Pomfrets	37.00	46.20	58.50	52.50	54.00
Pig-face breams	25.50	31.50	42.00	37.50	40.50
Red snapper	18.00	24.00	30.00	33.00	34.50
Barracudas	25.50	28.50	40.50	36.00	37.50
Group II					
Reef cod	18.00	24.00	28.50	31.50	35.50
Tuna	19.95	24.30	34.65	33.90	37.25
Sharks	16.50	20.70	28.30	24.55	26.40
Cat fish	15.80	21.90	30.75	27.70	25.95
Wolf herring	13.35	17.20	24.40	21.40	22.80
Mackerel	13.20	15.00	21.80	18.90	19.95
Scade	9.90	7.40	17.20	14.85	14.85
Group III					
Goat fish	7.50	12.60	20.55	16.95	21.20
Ribbon fish	6.20	8.80	14.00	12.60	16.70
Thread fin breams	7.85	12.00	20.25	20.70	22.50
Rays	6.75	9.40	18.30	14.30	16.30
Lizard fish	2.00	3.50	6.75	5.80	7.90
Indian pellona	5.80	7.50	9.80	9.25	11.80
Gold stripped sardine	7.10	9.75	15.00	13.25	13.95
White baits	5.80	8.55	14.25	12.00	14.20
Silver bellies	4.60	6.80	7.20	8.60	9.80

The quarterly minimum and maximum landing centre price and retail prices have been worked out and given in Table IX-8.

TABLE IX-8

SEASONAL MINIMUM AND MAXIMUM PRICES AT LANDING CENTRE AND REAIL MARKETS FOR DIFFERENT VARIETIES DURING APRIL 1992 - MARCH 1993

VARIETY	MINIMUM			MAXIMUM		
	Landing centre	Retails	Season	Landig centre	Retail	Season
Group I						
Seer fish	32.40	42.60	Oct-Dec.	42.00	67.50	Apr-June
Rainbow runner	28.50	39.00	Oct-Dec.	36.00	57.00	Jan-Mar
Pomfrets	27.00	40.50	Oct-Dec	37.00	58.00	Jan-Mar
Pig-face breams	13.50	25.50	Oct-Dec	25.50	42.00	Jan-Mar
Red snapper	10.50	22.50	Oct-Dec	18.00	36.00	Apr-June
Barracudas	13.50	24.00	Oct-Dec	25.50	40.50	Jan-Mar
Group II						
Reef cod	10.50	22.50	Oct-Dec	18.00	34.50	Jan-Mar
Tuna	12.60	24.00	Jul-Sep	19.95	37.30	Jan-Mar
Sharks	15.60	22.40	Jul-Sept	18.45	34.00	Apr-June
Cat fish	10.35	19.80	Oct-Dec	15.88	30.80	Jan-Mar
Wolf herring	7.05	12.40	Oct-Dec	13.35	24.40	Jan-Mar
Mackerel	8.70	14.85	Oct-Dec	13.90	25.90	Apr-June
Scads	5.15	15.45	Jul-Sep	9.15	22.35	Apr-June
Group III						
Goat fish	4.80	10.10	Jul-Sept	7.95	22.75	Apr-June
Ribbon fish	6.00	12.75	Jul-Sept	7.50	21.00	Apr-June
Thread fin breams	3.80	7.10	Oct-Dec	9.00	22.50	Jan-Mar
Rays	6.45	12.25	Jul-Sept	7.05	17.60	Apr-June
Lizard fish	2.00	5.80	Oct-Dec	6.00	15.15	Apr-June
Indian pellona	4.50	9.25	Jul-Sept	7.80	17.40	Apr-June
Gold stripped sardine	5.30	11.40	Jul-Sept	10.95	22.95	Apr-June
White baits	4.05	8.85	Jul-Sept	8.60	22.00	Apr-June
Silver bellies	3.00	8.10	Jul-Sept	4.60	10.20	Jan-Mar

The quarterly variation in landing centre price is very wide for pig-face breams, wolf herring, scads, thread-fin breams, lizard fish, sardines and white batis. The wide seasonal fluctuations of the prices of these varieties were in accordance with the volume of their landings. The minimum price was observed during October-December, for all varieties in group I, reef cod, cat fish, wolf herring and mackerel in group II, thread fin breams, and lizard fish in group III and during July-September for tuna, sharks and scads in group II and goat fish, ribbon fish, rays, pellona, sardines, white baits and silver bellies in group III. On the other hand, maximum prices in landing and retail prices were observed during the lean months of January-June for all the varietis. The monthly average primary, wholesale and retail price movements for selected varieties of fish are given in Figure IX-3 to 8.

The average annual prices of different varieties of fish at primary, wholesale and retail markets in Cochin region of Kerala during April 1992-March 1993 have been given in Table IX-9.

Seer fish, rain bow runner and pomfrets recorded comparatively higher prices and lizard fish, silver bellies and thread fin breams are available comparatively cheaper. The retail prices at the urban retail market of Ernakulam are higher than that of other retail markets. The percentage price difference between landing and retail points for the quality fishes in group I are comparatively lesser than the varieties in group II and group III categories. Almost all cheaper varieties given in group III category, the retail prices are more than double that of landing prices.

Fig. ix –3 PRICE SPREAD OF SEER FISH DURING 1992 - 93

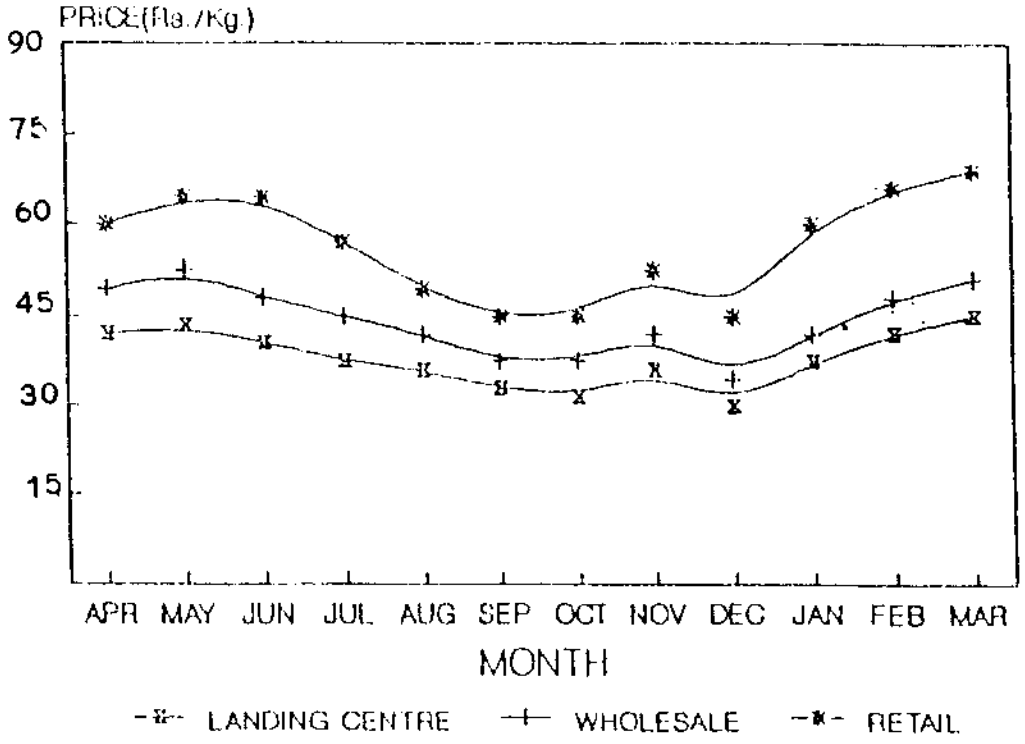


Fig. IX –4 PRICE SPREAD OF PIG -FACE BREAM DURING 1992-93

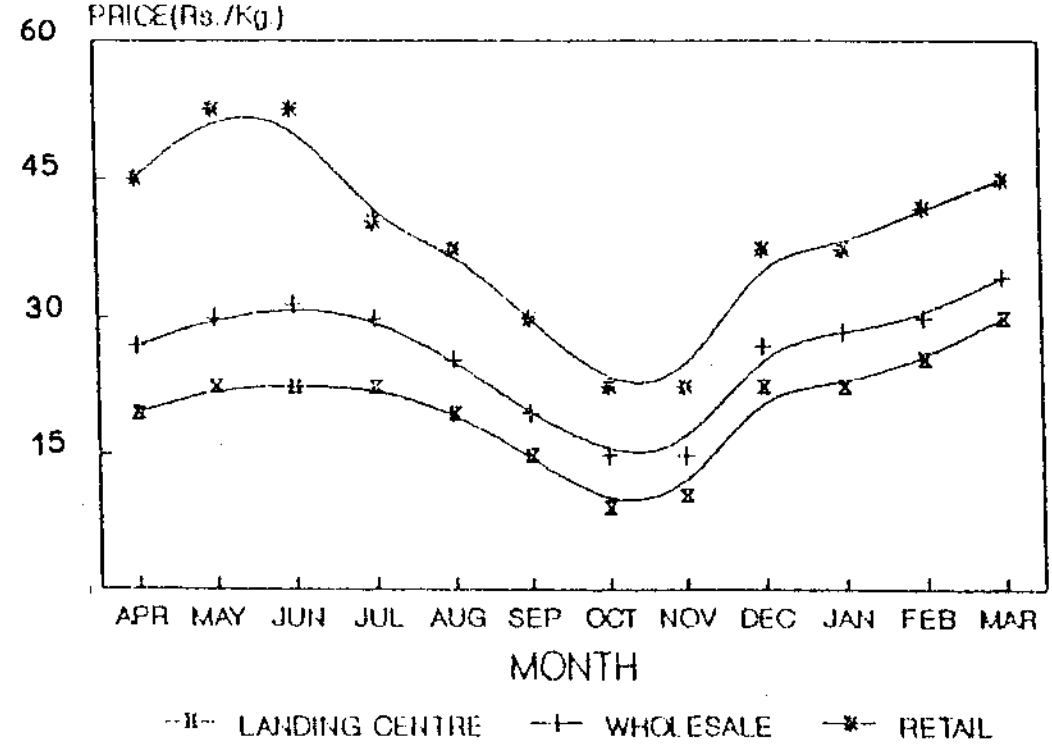


Fig.IX –5 PRICE SPREAD OF SHARKS DURING 1992-93

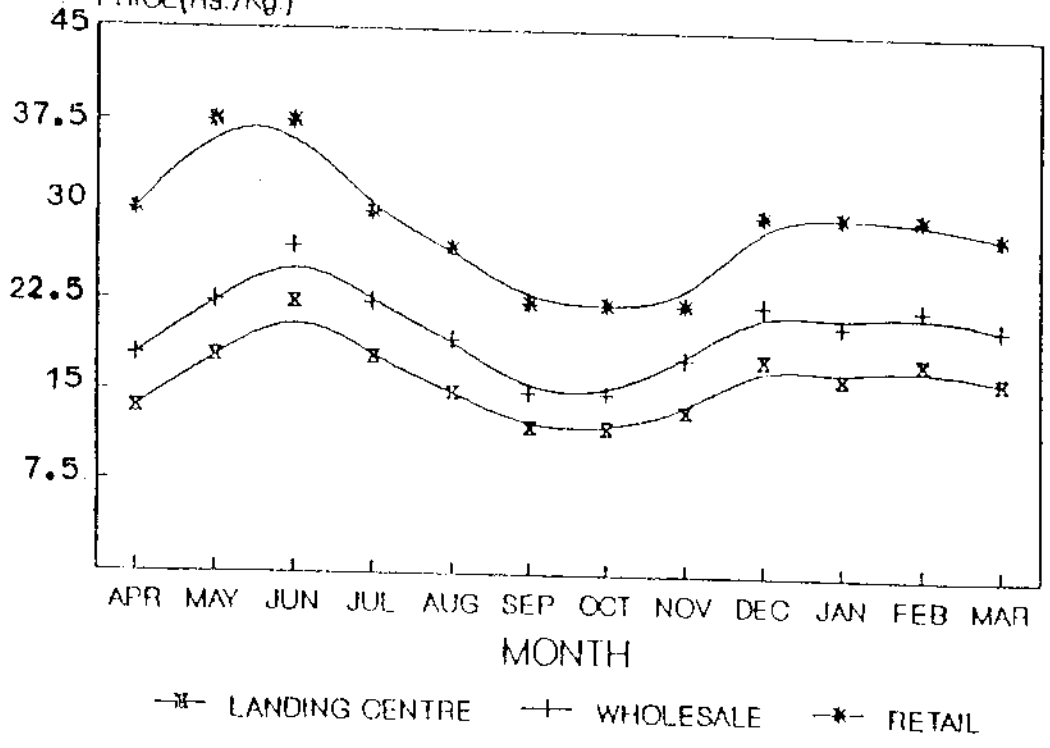


Fig. IX –6 PRICE SPREAD OF MACKEREL DURING 1992-93

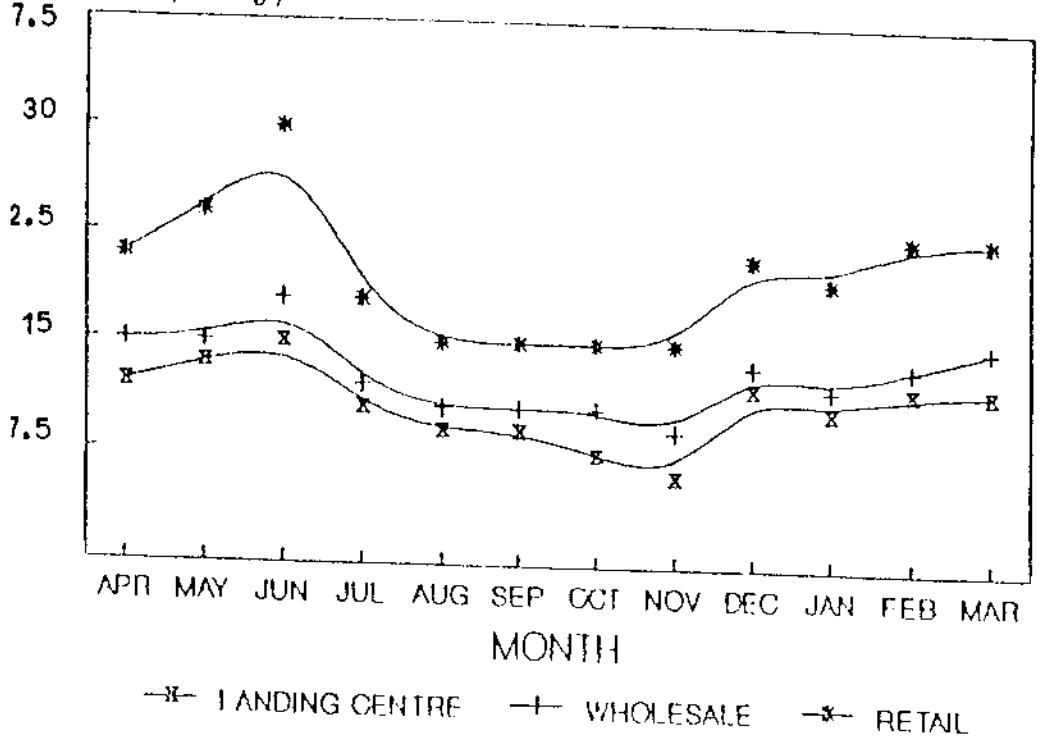


Fig. IX -7 PRICE SPREAD OF SILVERBELLIES DURING 1992-93

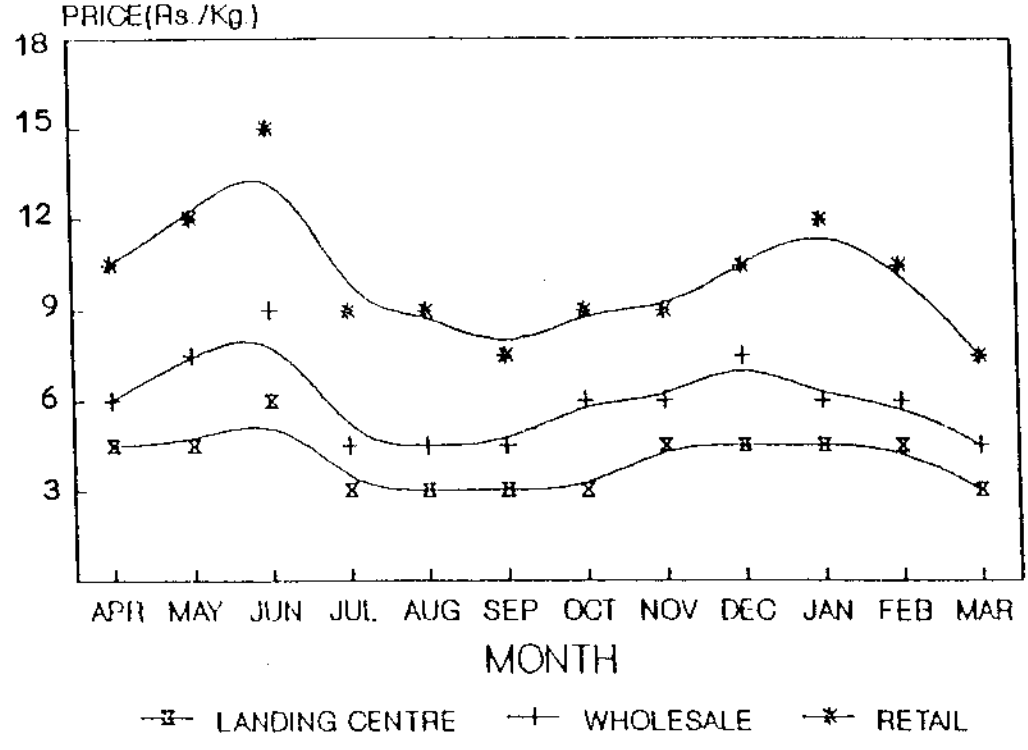


Fig. IX -8 PRICE SPREAD OF WHITE BAITS DURING 1992-93

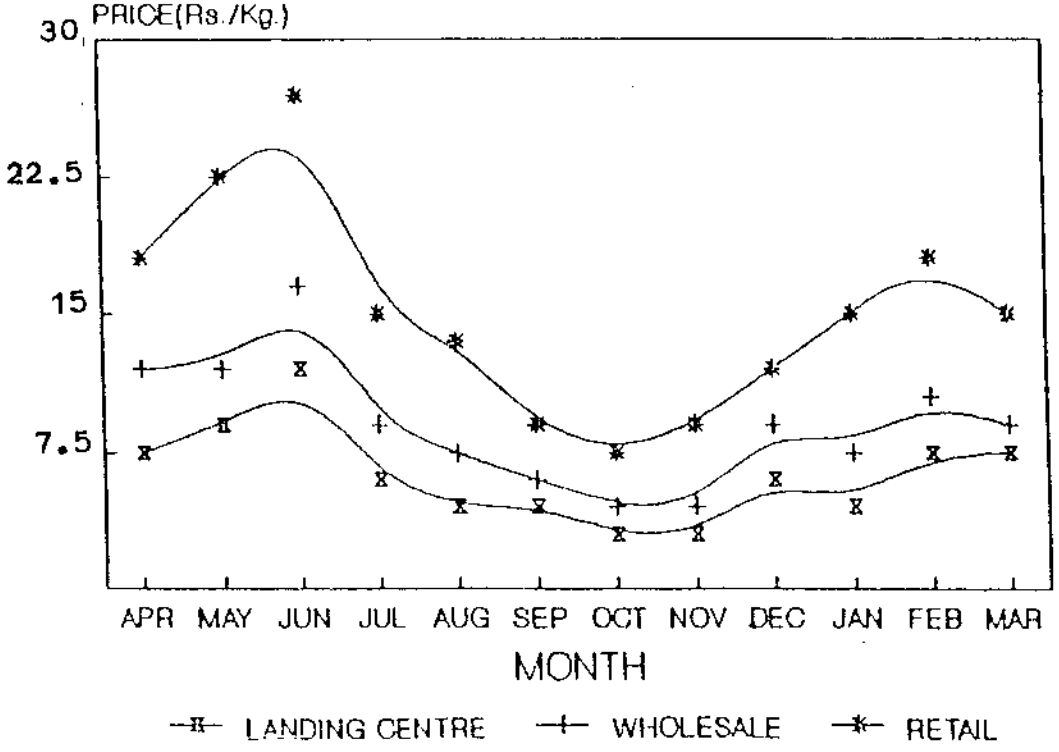


TABLE IX-9

AVERAGE PRICES (Rs/Kg) FOR DIFFERENT VARIETIES OF FISH IN COCHIN REGION DURING APRIL 1992-MARCH 1993

VARIETY	landing centre price (LP)	Whole-sale Price (WP)	Retail Price Market I (RP1)	Market II (RP2)	Market III (RP3)	Average
Group I						
Seer fish	36.00	43.35	57.00	50.55	53.50	53.25
Rainbow runner	30.30	36.90	50.60	44.00	46.10	46.90
Pomfrets	29.25	34.70	46.90	42.75	43.00	44.25
Pig-face breams	19.300	25.40	38.40	32.50	35.30	34.50
Red snapper	15.00	20.25	27.50	30.50	31.60	30.00
Barracudas	17.80	22.80	33.80	29.80	31.35	31.50
Group II						
Reef cod	14.15	19.30	25.80	27.45	30.65	27.75
Tuna	30.30	20.15	28.45	27.60	28.95	27.80
Sharka	16.50	20.80	28.75	24.40	24.00	25.50
Cat fish	13.50	19.50	27.50	25.00	23.60	24.75
Wolf herring	10.50	13.75	19.75	17.10	18.15	18.40
Mackerel	11.10	13.50	20.50	17.50	18.45	18.75
Scads	7.50	10.50	17.25	15.80	18.50	17.25
Group III						
Goat fish	6.15	9.80	16.65	14.85	17.60	16.50
Ribbon fish	6.30	9.25	15.45	13.50	16.20	15.00
Thread fin breams	5.80	8.25	12.60	11.25	14.25	12.75
Rays	6.80	9.60	17.60	17.40	16.05	16.15
Lizard fish	3.30	5.50	7.80	7.35	8.70	7.95
Indian pellona	6.00	8.70	13.60	12.15	14.70	13.50
Gold stripped sardine	7.20	10.35	16.65	14.00	14.20	15.00
White baits	6.00	8.80	14.70	12.25	13.35	13.50
Silver bellies	4.20	6.30	10.70	8.70	9.30	9.35

MARKETING MARGINS

The marketing margin accounted for a big chunk of the consumer price for most of the varieties of fish covered under the study. The margin is shared by auctioneers, commission agents, wholesalers and retailers and a portion goes towards marketing expenses including transportation. Marketing margins for different varieties of fish in Cochin region during April 1992 to March 1993 for fishermen-wholesaler-retailer chain and fishermen-retailer chain presented in Table IX-10 and 11 respectively.

TABLE IX-10

MARKETING MARGINS FOR DIFFERENT VARIETIES OF FISH IN CHANNEL-I DURING APRIL 1992-MARCH 1993 (FISHERMEN-WHOLESALER-RETAILER CHAIN)

VARIETY	Percentage distribution			
	Marketing margin (1)	Marketing costs (2)	Whole salers (3)	Retailers (4)
Group I				
Seer fish	21.00	9	27	64
Rainbow runner	20.30	9	25	66
Pomfrets	17.60	11	21	68
Pig-face breams	19.10	10	23	67
Red snapper	12.50	14	27	57
Barracudas	16.10	11	21	68
Group II				
Reef cod	11.60	12	33	55
Tuna	12.70	11	29	60
Sharks	12.15	11	25	64
Cat fish	14.00	10	34	56
Wolf herring	9.20	14	22	64
Mackerel	9.40	14	13	73
Scads	9.75	14	18	68
Group III				
Goat fish	10.50	9	27	64
Ribbon fish	9.15	10	23	67
Thread fin breams	6.80	13	24	63
Rays	10.80	9	18	73
Lizard fish	4.50	13	31	56
Indian pellona	7.60	12	25	63
Gold stripped sardien	9.45	10	24	66
White baits	8.70	11	22	67
Silver bellies	6.00	15	22	63

TABLE IX-11

MARKETING MARGINS FOR DIFFERENT VARIETIES OF FISH IN CHANNEL-II DURING APRIL 92 - MARCH 93 (FISHERMEN - RETAILER CHAIN)

VARIETY	Marketing margin	Percentage distribution	
		Marketing cost	Retailers margin
Group I	Rs.		
Seer fish	17.30	8	92
Rainbow runner	16.20	8	92
Pomfrets	14.30	9	91
Pig-face breams	15.60	9	91
Red snapper	15.75	9	91
Barracudas	13.70	10	90
Group II			
Reef cod	15.00	7	93
Tuna	13.00	8	92
Sharks	8.20	12	88
Cat fish	10.65	10	90
Wolf herring	7.70	13	87
Mackerel	7.50	13	87
Scads	10.50	10	90
Group III			
Goat fish	10.90	7	93
Ribbon fish	9.30	7	93
Thread fin breams	7.70	9	91
Rays	9.30	7	93
Lizard fish	4.95	13	87
Indian pellona	8.00	8	92
Gold stripped sardine	7.35	9	91
White baits	7.40	9	91
Silver bellies	5.10	13	87

In the fishermen-wholesaler-retailer chain, the marketing margins ranged from Rs.6 per kg. for silver bellies to Rs.21 per kg. for seer fish. Marketing costs accounted 9 to 15 percent of thçe marketing margins. The wholesalers share in the marketing margins for different varieties ranged from 13 per cent for mackerel to 34 per cent for cat fish and retailers margin ranged from 55 per cent for reef cod to 73 per cent for mackerel and rays.

The marketing margins are comparatively lower for most of the varieties in the fishermen-retailer chain. It ranges from Rs.4.95 per kg. for lizard fish to Rs.17.25 per kg. for seer fish. The marketing costs including transportation accounted for 8 to 12 per cent of the marketing margins of different varieties. However, the retailers receive a higher proportion of the margins ranging from 87 to 93 per cent as there were no wholesalers in the distribution channel.

SHARE OF FISHERMEN AND MIDDLEMEN IN THE CONSUMERS RUPEE

An earlier study on fishermen of shares in the consumer's rupee in Cochin region of Kerala indicated that fishermen received higher share in the consumer's rupee for quality fishes (Sathiadhas and Panikkar 1988). In the present study also, the higher share of producer in the consumer's rupee for quality fishes like seer fish and pomfrets in group I conformed the earlier findings. The percentage distribution of consumer's rupee for different varieties of fish to fishermen and other intermediaries in fishermen-wholesaler-retailer chain (Channel II) are given in Table IX-12 and 13 respectively.

TABLE IX-12

PERCENTAGE DISTRIBUTION OF CONSUMER'S RUPEE FOR DIFFERENT VARIETIES OF FISH IN CHANNEL-I DURING APRIL 1992-MARCH 93

VARIETY	Percentage share to			
	Fisher-men	Handling & Trans-port	Whole-salers	Retailers
Group I				
Seer fish	63	4	9	24
Rainbow runner	60-	4	9	27
Pomfrets	62	4	8	26
Pig-face breams	50	5	11	34
Red snapper	55	6	13	26
Barracudas	53	5	9	33
Group II				
Reef cod	55	6	14	25
Tuna	55	5	12	28
Sharks	58	5	10	27
Cat fish	49	5	17	29
Wolf herring	53	7	10	30
Mackerel	54	7	5	34
Scads	43	8	10	39
Group III				
Goat fish	37	6	16	41
Ribbon fish	41	6	13	40
Thread fin breams	46	7	13	34
Rays	39	5	10	46
Lizard fish	42	11	17	30
Indian pellona	44	7	13	36
Gold stripped sardine	43	6	13	38
White baits	41	6	13	40
Silver bellies	41	9	12	38

Fishermen's share in the consumer's rupee ranged from 37 percent (goat fish) to 63 percent (Seer fish) in Channel I (Table IX-12) increased to 39 percent to 68 percent in Channel II (Table IX-13) respectively. In almost all varieties, fishermen received higher share in the consumer's rupee in channel II where there is no wholesalers in between the producers and consumers. It confirms that lesser the number of intermediaries in the marketing chain higher is the share to fishermen in the consumer's rupee.

TABLE IX-13

PERCENTAGE DISTRIBUTION OF CONSUMER'S RUPEE FOR DIFFERENT VARIETIES OF FISH IN CHANNEL-II DURING APRIL 1992-MARCH 93

VARIETY	Percentage share to		
	Fisher-men	Handling & Trans-port	Retailers
Group I			
Seer fish	68	3	29
Rainbow runner	65	4	31
Pomfrets	67	4	29
Pig-face breams	55	5	40
Red snapper	49	5	46
Barracudas	56	5	39
Group II			
Reef cod	48	4	47
Tuna	54	4	42
Sharks	67	5	28
Cat fish	56	5	39
Wolf herring	58	6	36
Mackerel	60	6	34
Scads	42	6	52
Group III			
Goat fish	39	5	56
Ribbon fish	41	5	54
THread fin breams	43	5	52
Rays	43	5	52
Lizard fish	46	7	47
Indian pellona	45	5	50
Gold stripped sardine	50	5	45
White baits	44	6	50
Silver bellies	45	8	47

Fishermen received higher share for seer fish (63 to 68 percent) in group I, sharks (58 to 67 percent) in group II and sardines (43 to 50 percent) in group III categories of fish.

The percentage share towards marketing expenses of handling and transportation ranges from 4 to 11 percent of the consumer's rupee. The wholesaler's share ranges from 5 to 17 paise of the consumer's rupees for different varieties. Retailer's share ranges from 24 to 46 paise in channel I and 29 to 56 paise in Channel II of the consumer's rupee. In general, the wholesalers and retailers comparatively got more share in the consumer's rupee for cheaper varieties even with incurring higher handling and transportation charges.

MARKET INTEGRATION AND INTER-RELATIONSHIP BETWEEN PRICES

Much work has been done about the marketing efficiency of agricultural and marine products (Saxena, 1969 and 1970 ; Thakur, 1974; Rao 1971; Rao and Prasad 1978; singh and Gupta, 1983 Jose Murikkan, 1983; Srivastava and Dharmareddy, 1983; Panikkar and Sathiadhas, 1985 and 1989 Srivastava and Kulkarni 1985; Sathiadhas and Panikkar, 1988). Correlation coefficient is the commonly used measure of pricing efficiency and market integration in developing countries (Blyn, 1973; Harris, 1979; Lundal and Peterson, 1983; Naik and Arora, 1986). The correlation in prices between different markets for all the commercially important varieties of fish has been worked out and the correlation matrices are given in Table IX-14.

TABLE IX-14

CORRELATION MATRICES FOR SELECTED VARIETIES OF FISH

SEER FISH

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.89	1			
RP1	0.68	0.74	1		
RP2	0.69	0.75	0.69	1	
RP3	0.69	0.74	0.77	0.79	1

RAINBOW RUNNER

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.93	1			
RP1	0.79	0.84	1		
RP2	0.81	0.87	0.92	1	
RP3	0.78	0.85	0.92	0.93	1

PIG-FACE BREAMS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.96	1			
RP1	0.78	0.83	1		
RP2	0.76	0.77	0.85	1	
RP3	0.86	0.89	0.93	0.85	1

RED SNAPPER

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.96	1			
RP1	0.88	0.91	1		
RP2	0.85	0.87	0.89	1	
RP3	0.85	0.87	0.87	0.87	1

REEF COD

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.95	1			
RP1	0.88	0.92	1		
RP2	0.87	0.89	0.89	1	
RP3	0.85	0.88	0.87	0.93	1

SHARKS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.95	1			
RP1	0.76	0.74	1		
RP2	0.79	0.78	0.82	1	
RP3	0.79	0.77	0.74	0.86	1

TABLE IX-14 (Continued)

WOLF HEERING

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.94	1			
RP1	0.85	0.89	1		
RP2	0.91	0.91	0.88	1	
RP3	0.90	0.92	0.89	0.93	1

SCADS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.96	1			
RP1	0.83	0.84	1		
RP2	0.79	0.80	0.83	1	
RP3	0.79	0.80	0.81	0.95	1

RIBBON FISH

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.85	1			
RP1	0.65	0.67	1		
RP2	0.72	0.65	0.80	1	
RP3	0.72	0.65	0.40	0.66	1

BARRACUDAS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.96	1			
RP1	0.87	0.92	1		
RP2	0.91	0.89	0.86	1	
RP3	0.89	0.90	0.87	0.94	1

TUNA

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.92	1			
RP1	0.85	0.88	1		
RP2	0.82	0.84	0.89	1	
RP3	0.87	0.88	0.90	0.92	1

CAT FISH

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.89	1			
RP1	0.86	0.84	1		
RP2	0.89	0.78	0.89	1	
RP3	0.84	0.73	0.83	0.92	1

TABLE IX-14 (Continued)

MACKEREL

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.94	1			
RP1	0.82	0.81	1		
RP2	0.62	0.60	0.76	1	
RP3	0.79	0.78	0.93	0.77	1

GOAT FISH

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.90	1			
RP1	0.80	0.86	1		
RP2	0.79	0.78	0.90	1	
RP3	0.79	0.84	0.94	0.92	1

THREADFIN BREAM

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.94	1			
RP1	0.84	0.92	1		
RP2	0.	0.96	0.92	1	
RP3	0.	0.93	0.94	0.92	1

RAYS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.83				
RP1	0.53	0.58	1		
RP2	0.51	0.52	0.71		
RP3	0.56	0.55	0.64	0.84	1

LIZARD FISH

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.64	1			
RP1	0.85	0.54	1		
RP2	0.86	0.61	0.90	1	
RP3	0.82	0.59	0.86	0.91	1

INDIAN PELLONA

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.90	1			
RP1	0.63	0.75	1		
RP2	0.65	0.74	0.79	1	
RP3	0.73	0.72	0.72	0.76	1

TABLE IX-14 (Continued)

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.91	1			
RP1	0.75	0.88	1		
RP2	0.81	0.89	0.91	1	
RP3	0.77	0.82	0.86	0.92	1

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.94				
RP1	0.82	0.88	1		
RP2	0.85	0.89	0.94	1	
RP3	0.88	0.90	0.88	0.90	1

POMFRETS

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.64	1			
RP1	0.85	0.54	1		
RP2	0.86	0.51	0.90	1	
RP3	0.82	0.59	0.86	0.91	1

SILVER BELLIES

	LP	WP	RP1	RP2	RP3
LP	1				
WP	0.90	1			
RP1	0.63	0.75	1		
RP2	0.65	0.74	0.79	1	
RP3	0.73	0.72	0.72	0.76	1

The correlation coefficients of prices of different varieties of fish between markets are all positive and significant (P 0.01). Hence the functional relationship between the landing price (LP) wholesale prices (WP) and retail prices (RP) have been estimated by linear regression analysis (Y = a + bX) taking landing centre price as dependent variables and given in Table IX-15.

TABLE IX-15

RELATIONSHIP WITH LANDING PRICE

(Y=a+bx)

	SEER FISH			POMFRETS		
	a	b	r	a	b	r
WP	2.7097	1.0316	0.9343	1.2901	1.0676	0.6625
RP1	7.1477	1.8428	0.7322	6.8037	1.2009	0.8669
RP2	6.9388	1.0740	0.7716	7.1270	1.0496	0.8757
RP3	5.3630	1.2207	0.7731	7.8593	1.0136	0.8366
	RED SNAPPER			REEF COD		
WP	2.4363	1.0037	0.9779	2.1253	1.0278	0.9737
RP1	6.8797	1.0437	0.8966	7.1476	0.9614	0.8958
RP2	7.8115	1.1486	0.8721	6.6453	1.1262	0.8851
RP3	7.5446	1.0496	0.8694	6.9844	1.3224	0.8709
	SHARKS			WOLF HERRING		
WP	1.8862	0.9906	0.9686	1.5653	1.0984	0.9598
RP1	8.3216	0.8812	0.7819	1.8522	1.4924	0.8695
RP2	4.0142	0.0135	0.8128	1.3045	1.3167	0.9272
RP3	4.6149	0.9310	0.8082	1.3978	1.4109	0.9111
	SCADS			RIBBON FISH		
WP	1.8184	1.0595	0.9797	1.8435	1.0213	0.8653
RP1	5.5424	1.0060	0.8538	1.8361	1.7843	0.6717
RP2	3.6124	1.2074	0.8064	2.0435	1.4213	0.7294
RP3	3.4194	1.2075	0.8086	4.5695	1.2510	0.7347

TABLE IX-15 (Continued)

	RAYS			INDIAN HELLONA		
	a	b	r	a	b	r
WP	1.9181	0.9809	0.8505	1.4770	1.0806	0.9248
RP1	3.2882	1.6333	0.5512	3.3281	1.1773	0.6294
RP2	4.3458	0.9288	0.5342	1.8433	1.3121	0.7673
RP3	4.6554	1.1066	0.5761	4.2054	1.1355	0.7876
	WHITE BAITS			RAINBOW RUNNER		
WP	1.1917	1.1690	0.9285	4.5957	0.9405	0.9477
RP1	2.5760	1.5608	0.7680	10.3064	1.1103	0.8118
RP2	1.6650	1.3701	0.8307	8.2878	0.9925	0.8315
RP3	2.2036	1.4295	0.7631	11.0733	0.9237	0.7989
	PIG FACE BREAMS			BARRACUDAS		
WP	2.5023	1.0432	0.9760	3.9224	0.8675	0.9787
RP1	9.8898	1.1413	0.8041	10.7979	0.9056	0.8929
RP2	7.0972	1.0529	0.7802	7.6823	0.9401	0.9280
RP3	9.3976	1.0200	0.8804	8.9672	0.9189	0.9099
	TUNA			CAT FISH		
WP	3.3624	0.8902	00.9404	2.9932	1.0070	0.9118
RP1	7.5865	0.9844	0.8689	8.5530	0.9822	0.8768
RP2	7.0567	1.0118	0.8269	7.8097	0.8741	0.9087
RP3	6.2171	1.1811	0.8883	7.2060	0.8406	0.8623
	MACKEREL			GOAT FISH		
WP	1.5903	0.9821	0.9589	1.5823	1.2032	0.9153
RP1	4.1496	1.1462	0.8389	2.6720	1.8029	0.8232
RP2	3.8669	0.9146	0.6356	1.8452	1.9617	0.8123
RP3	2.7065	1.1572	0.8099	3.0732	1.8689	0.8106

TABLE IX-15 (Continued)

	THREADFIN BREAMS			LIZARD FISH		
	a	b	r	a	b	r
WP	0.7426	1.2373	0.9566	0.7092	1.3316	0.9711
RP1	1.6410	1.7593	0.8557	1.6756	1.1565	0.9400
RP2	0.3201	1.8792	0.7379	0.8255	1.8689	0.8919
RP3	1.6781	1.7857	0.8679	1.7309	1.3979	0.8239
	GOLD STRIPPED SARDINE			SILVER BELLIES		
WP	1.5518	1.1100	0.9582	0.7155	1.2527	0.9186
RP1	3.6957	1,3274	0.8439	2.2807	1.2664	0.6523
RP2	2.3011	1.2492	0.8691	2.5436	0.8005	0.6844
RP3	2.4311	1.2514	0.9019	2.5271	0.9674	0.7482

In most of the varieties the rate of change in wholesale and retail prices are more than one percent. The rate of change in wholesale price of barracudas, tuna, sharks, rays and mackerel, are found to be less than 1 percent.

Similarly the rate of change in retail prices are also less than one percent for these varieties in respect of some markets due to their seasonal abundance and excessive supply to these marketing centres during the season.

The relationship of whole sale price with retail price is estimated only for RP1 as the wholesale and retail transactions are carried out in the same market (Table IX-16).

TABLE IX-16
RELATIONSHIP OF WHOLESALE PRICE WITH RETAIL PRICE

Seer fish	13.8924	1.7593	0.7867
Rainbow Runner	3.5581	1.1852	0.8600
Pomfrets	19.1948	0.4771	0.5550
Pig-Face Breams	5.4694	1.1278	0.8493
Red Snapper	3.1602	1.0497	0.9256
Barracudas	5.4044	1.0597	0.9261
Reef Cod	4.009	0.9513	0.9356
Tuna	3.1558	1.0756	0.8987
Sharks	6.5002	0.8348	0.7576
Cat fish	5.9762	0.8731	0.8607
Wolf Herring	0.6729	1.3632	0.9088
Mackerel	2.7971	1.1092	0.8316
Scads	3.8644	0.9416	0.8642
Goat fish	1.5228	1.4632	0.8782
Ribbon Fish	0.7331	1.5629	0.6044
Threadfin Breams	0.8396	1.4975	0.9420
Rays	1.945	1.5305	0.5958
Lizard fish	1.1486	0.8429	0.9395
Indian Pellona	1.2308	1.3454	0.8406
Gold Stripped Sardine	1.633	1.2246	0.9019
White Baits	1.2886	1.4226	0.8999
Silver Bellies	1.2158	1.091	0.7663

Here also the rate of change in retail prices are more than one for most of the varieties except pomfrets, reef cod, sharks cat fish and lizard fish. The arrival of substantial quantity of the above varieties directly from the landing centre for retail sales during the season is mainly, responsible for this.

POLICIES FOR FISH MARKETINGS : NEED FOR CHANGE

Several lacunae exist in the present fish marketing system. There are many hazards in handling fish as it is a highly perishable commodity. Preserving fish from its perishability until it reaches the consumer is one of the essential requisites for increasing its marketability. Modern fish marketing policy should envisage not only meeting the existing demand for fish, but also tapping the potential demand in the important markets. Changing the fish form (value added product) according to the tastes and needs of the consumers would result in more sales fetching higher price. For the new fish products constant advertising has to be done so that the public are aware of these new products.

In China, government has a policy that all fish should be degutted before selling. This should be done in our country also. This is a hygenic measure which will ensure that people who eat fish are not affected by any stomach diseases. Spoiled fish is dangerous to people's health. Ungutted fish without proper icing will make the fish to putrify very soon. Hence the need fo degutting. In most of the fish markets minimum facilities are not there to boost up the marketing methods.

Proper grading or weighing is not done for fresh fish, though in some centres dry fish is properly weighed and sold. Adequate sheds for auctioning or facilities for preservation are not existing in many marketing centres of marine fish. Several malpractices are also followed by the fish traders and sometimes even the spoiled fish is thrust on the consumers. Hence quality control in fish marketing is very essential.

Due to great uncertainities in fish production, the high perishability of fish, collection of fish from too many scattered coastal landing places, with many species and many demand patterns with wide fluctuations in prices, and lack of suitable vehicles, the arrangement for supplying quality fish continuously in the market without delay becomes relatively more difficult (Rao, 1983). Although middlemen are necessary, a long chain of them in fish trading tend to inflate marketing costs.

GOVERNMENT POLICIES - AN EVALUATION

To develop the fishery industry and solve its marketing problems the Government has implemented a number of policies and programmes. The fish marketing through fishermen co-operatives has been encouraged. The state owned Kerala Fisheries Development corporation (KFDC) also has undertaken some selective buying and selling. Integrated fisheries Project, buy the fresh fish process and market them as canned fish which can be preserved for longtime. This value added product fetches higher price in the market. However, these efforts could not produce the desired results. The present marketing policies and price structure do

not provide any motivation to the fishermen to increase the fish production. Even the occasional bumper catch does not help the fishermen to increase his income from fishing. This can be improved only through Government action in announcing a support price for those varieties which are caught in large quantity now and then (Panikkar and Sathiadhas, 1989). The support price can be effectively implemented through a public agency having sufficient storage, processing and distribution facilities.

CHAPTER X

SUMMARY AND CONCLUSIONS

The importance of fishery economy and most of its potentialities for the overall development of the Kerala state have been revealed from the present study on the production and Marketing Management of Marine Fisheries, carried out along Kerala Coast. Fishermen have various technological options with varying investment range. The production trend of marine fisheries for the last 42 years (1950-1992) indicates an upward trend. The increase is attributed mainly to mechanised sector. In terms of abundant fish catch, the dominant groups among the pelagic groups are the oil sardine, mackerel, whitebaits, seer fish, tunnies, carangids and ribbon fishes, whereas, prawns and cephalopods among the demersal groups of fishes contributed higher production in Kerala.

The operation of catamarans with single type of gear throughout the year in the artisanal sector is found to be uneconomical. The combination of atleast 3 types of gill nets operated by catamarans are found to be efficient and economicals. Further, under this category, catamarans operating Karavala, Thanguvala and Vattavala in high investment group and Koruvala, manduvala and choodavala in low investment group are found to be comparatively more efficient than the other units. The earnings of the catamaran units with 3 types of above nets can further be increased, if the fishermen supplement hook and line also along with other nets.

The plank-built boats with shoreseine operations along Kerala coast slowly disappearing due to uneconomical returns to fishermen. Further the economic efficiency measures indicate that the plank built boats operating sardine gill net and choodavala is hardly sustainable and to realise optimum returns, motorisation of these units and diversified fishing are essential.

The study indicates that the motorised Catamarans should concentrate more on gill net and vattavala. The operation of hook and line is more profitable among the various gear combinations by motorised plank-built boats. These units could venture in to deeper waters to get higher returns.

All types of trawlers and gillnetters in the mechanised sector along Kerala coast are found to be economically viable and profitable. The study further indicates that though the catch rates declined and cost of operation of the mechanised boats increased, better prices for the bye catches (miscellaneous) led to the success of these units. The present analysis also indicates that a trawler can survive even without catching prawn as the catches seasonal during few months of the year only. By increasing the number of gillnetters along the Kerala coast will enhance the harvest of pelagic fishes which are having bigger demand in the domestic market.

The price of the marine fish and its products have been considerably increased over the years than all other food commodities. The average prices of different varieties of fish fluctuate widely at different seasons. The study indicates that the marketting margins

received by the middlemen for most of the varieties are high. The quality fish such as seer fish, and pomfrets fetched comparitively higher share in the consumer's rupee for the fishermen. Fishermen's share in the consumer's rupee ranges from 36% to 68% for different varieties. The whole saler's share ranges from 5% to 17% and retailer's share from 24% to 59% of the consumer's price. Further, the prices at landing centres wholesale and retail markets were found to be highly correlated for most of the fishes.

TEST ON HYPOTHESIS

"Indigenous low cost fishing units cannot survive in the long run and all out mechanisation is the only remedy for optimising the marine fish production" is the first hypothesis and it is not found to be correct. The study indicates that several types of fishing units with different investment range are available to fishermen. Each type of craft gear combination has its own merits and demerits. The co-existence of most of these innumerable techniques and technology are an imperative due to the seasonal nature of marine fisheries and other environmental factors. Mechanisation involves additional capital investment and high operating cost. This becomes uneconomical to venture into the sea in the off season. On the other hand mechanisation leads to over-fishing and destruction of juvenile and depletion of certain species.

The second hypothesis that "Motorisation of the country craft helped the fishermen to improve their living conditions" is found to be correct. The motor replaces human labour power for propelsion of the craft. This reduces the time taken to reach the fishing ground.

Due to the saving of time it may be possible to tap additional resources. Also, fish can be brought to the shore in shorter time maintaining the freshness which fetch better prices. Above all the physical strain of fishermen in rowing is almost eliminated and this helps in keeping better health and more leisure time for social engagements. Thus the socio-economic conditions of the fishermen's family could be improved.

The third hypothesis that "The shrimp catch per units effort of trawlers is continuously declining due to over fishing, consequently, its sustenance is being threatened", is partly correct. As stated, the CPUE for trawlers is declining in Kerala. However, the trawlers are earning sustained revenue due to the recent price escallation of all varieties of fish including trash fish and the sustenance is not dependent entirely on shrimp catches.

The production function analysis reveal that the fourth hypothesis, "In marine fishery, fishermen use factors of production in a rational way" is proved correct to a certain extent. The cost of production of fish such as fuel cost, repair and maintenance cost, other operating cost etc., labour productivity and other key economic indicators of different craft gear combinations show that fishermen are cost-conscious. But they are unable to select the most appropriate technology mainly due to financial constraints.

The fifth hypothesis that "Lesser the number of intermediaries in the fish marketing chain higher is the share to fishermen in the consumer's rupee", is proved to be correct. It is evident that in almost all varieties, fishermen received higher share (36% to 68%) in the consumer's rupee in channel II where there is no wholesalers in between

the producers and consumers.

The last hypothesis that "Acoustic Survey is the best method for the fish resources estimation which provides informations useful for fishery management information" is found to be partially correct. The Acoustic survey could be completed along Kerala Coast covering the area of EEZ within 10 days and the fish biomass could be estimated. This enables to have the fishery management information such as the resources, migratory pattern, spacial distribution within short time at less cost which is not practicable by any means other than Acoustic Survey. However, the limitation of Acoustic Survey is that the estimate is always higher because it accounts anything and everything submerged in the water and the fish biomass need be separated tactfully as it is subjected to human error. Also some demersal resources such as prawn which is burried at the bottom may not be covered by the integrator system of Acoustic Survey resulting under estimation of the fish boimass.

AREAS FOR FURTHER RESEARCH

The mini trawlnet operation by the non-motorised plank built boats in the near shore area along the Kerala coast is in an increasing trend and is economically viable and provide considerable employment. But the catch composition of these units are mostly comprised of juvenile prawns. If the indiscriminate operation of these units are allowed to

continue they will deplete certain species. Further, investigations are required to ascertain the advisability of operating these units along Kerala coast.

So also some of the richest fishing and breeding grounds of prawns lying between the main land and chain of islands along the Kerala coast has been almost destroyed by various means. The preservation of the eco-system gains so much of importance when considering the present and future fishing industry. Further, in depth studies should be conducted to formulate regulatory measures.

Trawl fishing has been banned in Kerala for 30 to 40 days every year during monsoon period (June to August) which is considered as spawning period for prawns. The impact of ban on marine fishery resources and consequently its socio-economic implications have to be further probed by in depth bio-economic studies.

The echo magnifier system, the latest invention in the Acoustic instrumentation may be introduced in the Acoustic Survey system so that the demersal fishery resources are effectively surveyed by the Acoustic Survey. And also Hydro Acoustic Data Acquisition System (HADAS), a software may be developed and the Acoustic Survey Data be processed through electronic data processing system (EDP) for better accuracy and speed.

POLICY IMPLICATIONS

The study reveals that the gillnetters yield higher profitability. However, the number of gillnetters used in Kerala Coast are comparatively less. It is mostly attributed to the comparatively higher level of investment on gillnets, above 1.5 lakhs and the risk involved in the operation of this net which faces the threat of being damaged by the trawlers. Due to this risk, even the motorised plank-built boats are reluctant to operate gillnets. As per the marine fisheries regulations act of 1985, the trawl fishing is allowed only beyond 5 km from the shore. If it is strictly implemented it will overcome many problems. Other two options open to the Government for increasing the number of gillnet units are, the introduction of an insurance policy for the gillnetters and encouraging the operation of mechanised gillnetters in deeper waters.

In the recent years, the catch rate of trawlers has declined considerably. However, the increase in price of fish both in internal and external markets led its survival. Further additions in the present fleet of about 5000 mechanished crafts is not necessary along Kerala Coast. Diversification of trawlers into pair trawling and fish trawl operations should be encouraged to increase the profitability of these units and also to reduce the high degree of dependence on shrimp catches.

There is enormous scope for increasing the marine fish production of Kerala. The resources available in the wadge Bank region are the

quality fishes such as tuna, cuttle fish etc. and offer Kerala a challenging task to increase the fishing effort. This region can be further exploited by rgular mechanised gillnet and fish trawl operations.

The vast pottentialities of deep sea resources are yet to be exploited. The poaching by foreign vessels in the Exclusive Economic Zone (EEZ) of Kerala is an eye opener for encouraging the indigenous deep sea fishing.

Regarding the formulation of new marine fisheries policies, the non-motorised units should be provided an exclusive fishings-zone for fishing so that the motorised unit will extend their fishing operation to the wider areas. The utilisation of sails by the motorised units has to be encouraged as a fuel saving measure.

The maximum labour force is employed in the traditional sector of the marine fisheries. Most of the fishermen in Kerala are only wage earners without having any fishing equipments. The pressing problem for them is the lack of finance to acquire proper fishing implements. Hence the Government financial institutions and commercial banks can formulate some schemes to provide credit facilities to these category of fishermen on easy terms and conditions for acquiring fishing implements.

Over the recent years fish marketing in Kerala has been transforming to a modern stage despite the infrastructure constaints and

inherent complications in the marketing system. The role of the middlemen in the fish marketing system is continuing unabated due to the absence of institutional involvement. This adversely affects the interests of both fishermen and the consumers. Proper grading or weighing is not done for fresh fish and there is no proper sheds for auctioning of facilities for preservation at most of the marketing centres. Inefficient transportation system affects the proper distribution of fish uniformly resulting the existence of area of fish surpluses and deficits side by side in the internal marketing system. Lack of marketing infrastructure is another factor responsible for lesser returns to fishermen. It may not be possible to start ice plants, freezing plants andother storage facilities in each fish-landing centre. However, the Government can provide these facilities at least for a cluster of villages through the fishermen co-operative societies. After successsful demonstration, these units can be handed over to local fishermen societies on equity participation basis.

Fish marketing societies with the full involvement of local fishermen may arrange to supply fishing inputs and marketing of fish. The present marketing system and price structure do not provide any motivation to the fishermen to increase the fish production. Even the occasional bumper catch do not help the producer to increase his fishing income. This situation can be improved only through Government policy by accouncing a support price for those varieties which are caught in large quantities now and then. The support price can be efficiently

implemented, only when there is a public agency to purchase fish. Such an agency should be provided with processing, storage and distribution facilities.

Vast stretches of coastal land and brackish water along Kerala coast can be utilised for aquaculture and mixed planting of casuarina, cashew and coconut so that the marine fishermen can be provided with alternate employment opportunities especially during lean season. In this connection it is advisable to form a coastal zone Development Authority (CZDA) exclusively for the development of the entire marine fishing sector.

In the mechanised sectors, the boat owners must be educated about the advantages of the electronic gadgets like sonar for searching the fish shoal, Echo-sounder for detecting fish and depth and trawl sonde for catching maximum fish (aimed trawling) and provide these instruments on subsidised rates by the Government. So that the fishermen can avail the advantages of the modern development in fishery electronics resulting the enhanced fish production. In due course a legislation may be passed to have the navigation equipment and fish finding equipments installed on board the fishing vessel compulsorily in future.

An arrangement need be made by the Government to pass on the Research and Development (R & D) findings on craft gear and fishing

technology by the Government research organisation such as Central Marine Fisheries Research Institute (CMFRI), Central Institute of Fisheries Technology (CIFT) be transfered to fishing industry.

A new organisation named fishery corporation of India, similar to shipping corporation of India may be organised to look after the management of man power development in the fishery sector and to facilitate deepsea fishing activities in the international standard to exploit deep sea resources at all India level.

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